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JUNE, 1950 VOLUME 48 • NUMBER 6

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YOU CAN'T AFFORD TO GAMBLE AT HIGH PRODUCTION RATES

Here's how GENERAL ELECTRIC plays it safe on this new high-speed nickel-chrome plating line with PENNSALT CLEANER

Plating that's bright, that won't blister or peel . . . is a "must" for General Electric household appliances. To get such results on a high-production line . . . all the time, with every unit . . . requires fast, efficient metal cleaning prior to plating.

That's why G-E uses a Pennsalt Metal Cleaner in its new plating installation at Bridgeport, Conn. Months ago, experts in G-E's Heating Device Division put this Pennsalt Cleaner through rigid tests.

Here are three big reasons why they've used it ever since . . .

1. **Practically no rejects to tie up production.** G-E technicians found that they could hold rejects, caused by spotting or "color", down to an absolute minimum. Pennsalt Cleaners do the job *right*.

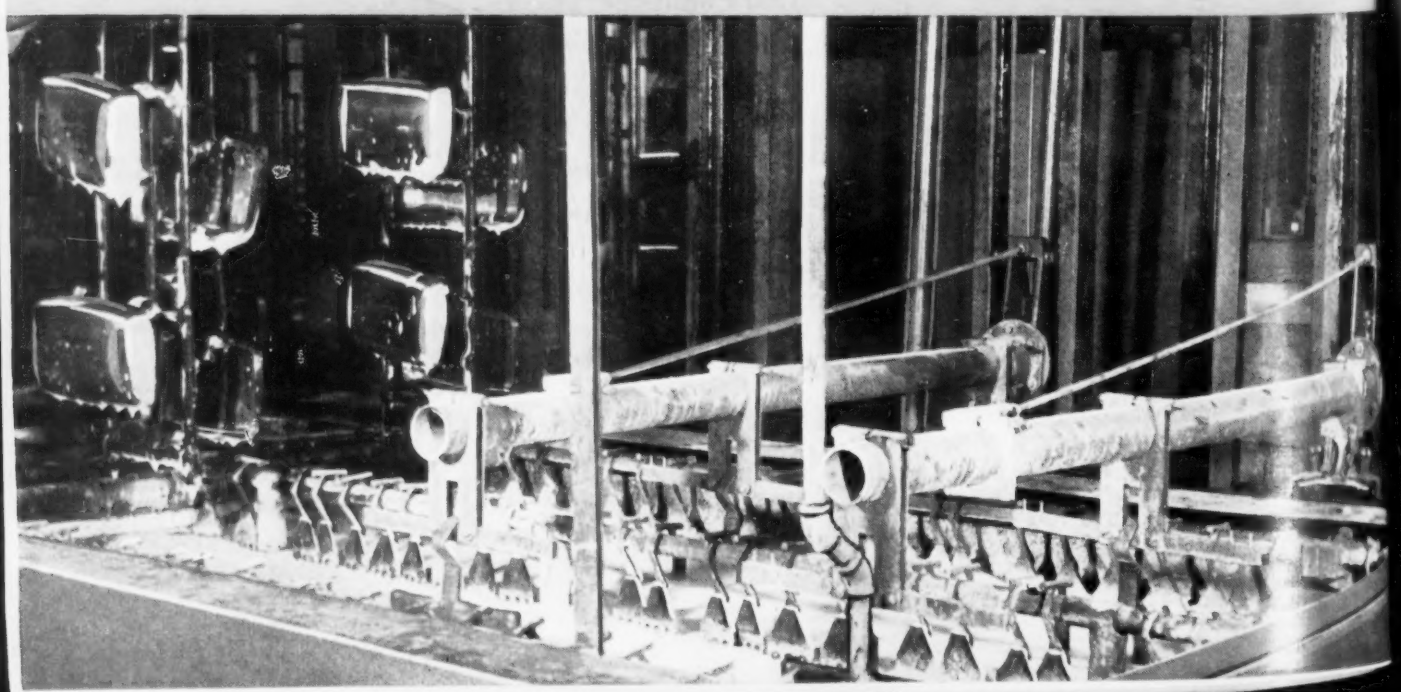
2. **Rock-bottom cost per unit cleaned.** On their new installation, G-E platers dump tanks only once a month or less . . . real economy! Pennsalt Cleaners make a long-lasting, uniform solution *every time*.

3. **Superior all-around performance.** G-E achieves highly efficient, fast, trouble-free operation. Pennsalt Cleaners have been scientifically developed to meet actual plant conditions.

No wonder G-E plating men have confidence in Pennsalt Cleaners! They get the benefits of Pennsalt's long experience in the metal cleaning field. You can, too!

Write today for further information to: Special Chemicals Department, Pennsylvania Salt Manufacturing Company, Philadelphia 7, Pa.

1. ***First cleaning of shells*** **prior to nickel plating. (Anodic, 30 sec., 6 v., 12 to 14 oz. Pennsalt Cleaner per gal.)**



ESTABLISHED 1903

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

METAL FINISHING

VOLUME 48 • NUMBER 6 • JUNE 1950

Thomas A. Trumbour, *General Manager*

The publishers take pleasure in dedicating this first International issue in the history of the electroplating and allied industries to Thomas A. Trumbour, general manager of *Metal Finishing* and its predecessors since 1901. Tom's name has been linked with the plating industry through all these years.

1901—Joined the staff of the infant journal, *Aluminum World*, after graduating from MacChesney's Business College in Paterson, N. J.

1903—Name of publication changed to *Metal Industry* in order to cover all the non-ferrous metals.

1909—By this year *Copper and Brass*, *Brass Founder and Finisher*, and *Electro-Platers' Review* had been merged with *Metal Industry*, which had now become the leading publication in this field.

1914—Attended the first national convention of the American Electroplaters' Society, held in Chicago, and up to the present is the only member of the Society (Honorary member, New York branch) who has attended every national Convention.

1925—Attended the first meeting of the International Fellowship Club, an organization of suppliers to this industry.

1929—Elected secretary of the International Fellowship Club, an office which he has held ever since.

1930—Initiated the series of *Guidebooks*, of which over 175,000 have been distributed in eighteen successive editions.

1939—*Brass World and Platers Guide* were merged with *Metal Industry* as was also the monthly publication *Metal Cleaning and Finishing*.

1940—*Metal Industry* becomes *Metal Finishing*, including a section on organic finishing, which at present is a separate publication.

1943—Elected permanent secretary of the International Fellowship Club.

1949—On the anniversary of his twentieth year as secretary, Tom was cited by the membership and presented with a silver gift.

Tom and his wife Elizabeth M., live in Hawthorne, New Jersey and have six children, five of whom are associated with this publication: Mrs. Joan T. Wiarda, sales manager; John E. Trumbour, equipment and news editor; Frances Drennan, Elizabeth Meyers, and Dorothy Tschopp, circulation department. He is an active golfer and a member of the Out-Of-Bounds Country Club and the Knights of Columbus.

L. H. Langdon

Publisher

Statler Hotel—Headquarters for the Convention

Electroplaters to Meet in Boston June 11-15, 1950

THE 37th Annual Convention of the American Electroplaters' Society will this year form the background for the Fourth International Conference on Electrodeposition. Co-operating with the A.E.S. on the international aspect of the meeting is the British equivalent of the A.E.S.—the Electrodepositors' Technical Society, which this year is celebrating its 25th anniversary.

Three previous International Conferences have been held, two in London, in 1937 and 1947, and one at Asbury Park in 1939. Both meetings held in London were sponsored by the E.T.S. The object of these International Conferences is the free exchange of knowledge in the metal finishing field by experts from all over the world.

This year's convention will feature intensive technical discussion of two of the plating industry's most vital questions — Levelling Action as a Function of Electrodeposition, and Mechanical Finishing. In view of the universal interest in more economical finishing procedures to meet today's competitive market, it is expected that these two special sessions will be well attended. In addition to the above special sessions, there will be a series of papers on general plating subjects and a report of the progress made by the various A.E.S. research projects now under way.

A luncheon will be held for all members of the Electrodepositors' Technical Society, at which time American members can meet and become acquainted with foreign members.

Founder members of the A.E.S. will be honored in special ceremonies. It is expected that 12-15 of the original members who were members of the Society in 1913 will be present to take part in this celebration.

Along with the technical program will go a round of social activities that this year bids fair to eclipse former convention entertainment. A gigantic old-fashioned New England Clambake and Outing will be the high-spot of the varied program arranged by Chairman *Manson Glover* and his committees. Another novel experience will be

Arthur Logozzo
Supreme President

William J. Neill
Supreme First Vice-President

C. F. Nixon
Supreme Second Vice-President

F. J. MacStoker
Supreme Third Vice-President

S. S. Johnston
Past Supreme President

Dr. A. Kenneth Graham
Executive Secretary and Business Manager

the special program of the world-famous Boston Pops Orchestra which will be played for the visiting electroplaters and their guests. The convention will wind up on Thursday evening with the usual Banquet, introduction of new officers, and the awarding of honors for outstanding accomplishments during the year.

Supplementing the Society-sponsored social events will be the special program of events sponsored by the International Fellowship Club, including the Open House Party for all registrants on the first night, the annual Fellowship Golf Tournament, Games party for the Ladies, and the Fellowship Club luncheon, open to all representatives of manufacturers and supply houses in the metal finishing industry.

The ladies attending will be especially fortunate this year. Not being confined to the routine of technical meetings, they will be free to enjoy the hospitality and atmosphere of the nation's most picturesque and historic city. A number of scheduled events have been arranged for their special benefit, but there will be sufficient free time remaining for shopping and personal excursions. Details of the Ladies Program will be found on the next pages.

An exhibit of plated items from the various branches of the Society will also be held. The best exhibit will be awarded the annual Branch Exhibit Trophy.

TECHNICAL PROGRAM

Monday — June 12

MORNING—9:30 A.M.

Opening Session. Special greetings to the Founder Members, speeches of welcome from the national officers, the convention committee, and the mayor of Boston. Business Session.

AFTERNOON—2:00 P.M.

Presentation of the following papers:

Self-Regulating High Speed Chrome Plating Bath, by Dr. J. E. Stareck, H. Mahlstedt, and F. Passal, of United Chromium, Inc.

Nodule Method of Measuring Adhesion of Plated Coatings, by Dr. A. Brenner and V. D. Morgan, of the National Bureau of Standards.

Advances in Electrodeposition in the Graphic Arts, by E. I. Peters, Pontiac Engraving and Electrotype Co.

High Speed Nickel Plating of Curved Stereotypes, by K. L. Koessler and R. R. Sloan.

Strides in German Electroplating 1940-1950, by Dr. R. Springer, of Leipzig, Germany

Tuesday — June 13

MORNING—9:00 A.M.

SYMPOSIUM ON "LEVELLING"

Measurement of Surface Smoothness, by Dr. H. L. Kellner, of Lea Mfg. Co.

Measurement of Surface Roughness with the Interference Microscope by A. G. Strong and F. Agburn, National Bureau of Standards.

Levelling and Smoothing by Chemical and Electrochemical Polishing, by Dr. C. L. Faust, of Battelle Memorial Inst.

Levelling with Periodic Reverse Current Plating, by G. W. Jernstedt, of Westinghouse Electric Co.

Micro-throwing Power of Plating Solutions, by C. E. Reinhard, of the New Jersey Zinc Co.

AFTERNOON—2:00 P.M.

CONTINUATION OF LEVELLING SYMPOSIUM

Levelling Ability of the Cobalt-Nickel Baths, by Dr. L. Weisberg, Consultant, and M. B. Diggin, of the Hanson-Van Winkle-Munning Co.

Surface Contour and Levelling, by A. H. DuRose, W. P. Karash, and Dr. K. S. Willson, of the Harshaw Chemical Co.

Wednesday — June 14

MORNING—9:00 A.M.

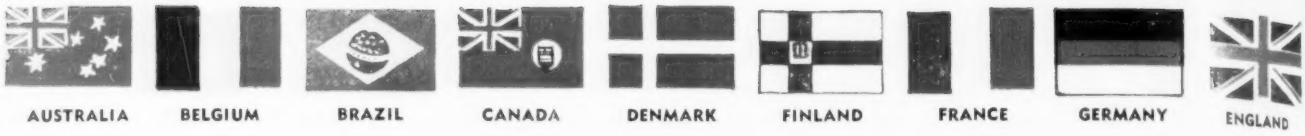
SYMPOSIUM ON MECHANICAL FINISHING

Abrasive Tumbling, by H. M. Goldman, of Enthone, Inc.

Abrasive Belt Polishing, by E. E. Oathout, Behr-Manning Corp.

Reducing Finishing Costs of Formed Metals Through Pre-Drawing Phosphate Coatings, by V. M. Darsey and H. J. McVey, Parker Rust Proof Co.

Liquid Buffing, by E. T. Candee and



S. L. Doughty, Jr., of Lea Mfg. Co.

AFTERNOON—No technical sessions. Clambake and Outing at Nahant

Thursday — June 15

MORNING—9:00 A.M.

A.E.S. RESEARCH SESSION

Reporting and Use of Research Data, by G. M. Cole, of Ternstedt Div., of General Motors

Why Pay for Porosity Research? by Dr. W. A. Wesley, of International Nickel Co.

Use of Radioactive Isotopes for Determination of Current Distribution, by Dr. J. Kronsbein, of Evansville College

AFTERNOON—No technical sessions. Annual meeting of the Society, election of officers, committe reports.

GENERAL CONVENTION SCHEDULE

SUNDAY — JUNE 11

4:00 p.m.—8:00 p.m.

Registration, Mezzanine, Hotel Statler.

The Registration Fee of $10.00 entitles registrant to a book of tickets admitting to certain Convention functions and activities —listed in this program.

MONDAY — JUNE 12

8:00 a.m.

Registration, Mezzanine, Hotel Statler.

9:30 a.m.—12:00 noon

Opening Session, Georgian Room, Hotel Statler.

Invocation: The Reverend *Frank C. Mesle*, Rochester Branch.

Welcome to Boston: The Honorable *John B. Hynes*, Mayor of Boston.

Welcome to Electrodepositors' Technical Society: *Arthur W. Logozzo*, President, A.E.S.

Testimonial to Founder Members: *Dr. George P. Swift*, Secretary, Boston Branch.

Greetings from Boston Branch: *Louis V. Gagnon*, President.

Address: *Daniel Gray*, Chief Chemist, Oneida Ltd.

First Business Session: *Arthur W. Logozzo*, President, A.E.S., presiding.

9:30 a.m.—2:00 p.m.

National Association of Metal Finishers, Board of Directors Meeting and Luncheon, Parlor F. Hotel Statler.

12:00 noon

Education Committee Luncheon, Terrace Room, Hotel Statler.

Manson Glover
General Chairman of the Boston Convention

12:15 p.m.

International Fellowship Club, 26th Annual Luncheon, Ball Room Foyer, Hotel Statler. For suppliers and their representatives only.

2:00 p.m.—4:30 p.m.

First Educational Session, Georgian Room, Hotel Statler. See Technical Program for list of papers to be presented.

8:30 p.m.—1:00 a.m.

Open House Party. Imperial Ball Room Suite, Hotel Statler. Auspices of the *International Fellowship Club*. Music—Dancing—Buffet served at 10:00 p.m. A ticket to this event is included in the Convention book.

TUESDAY — JUNE 13

7:45 a.m.

Education Committee Breakfast — Cafe Rouge, Hotel Statler.

8:00 a.m.

Registration, Mezzanine, Hotel Statler.

9:00 a.m.—11:30 a.m.

Second Educational Session. Symposium "Smoothing and Leveling of Electrodeposits." See Technical Program for list of papers to be presented.

12:00 noon

Electrodepositors' Technical Society Luncheon—Salle Moderne, Hotel Statler.

National Association of Metal Finishers—Job Platers' Luncheon—Parlor C. Hotel Statler.

Education Committee Luncheon—Terrace Room, Hotel Statler.

2:00 p.m.—4:30 p.m.

Third Educational Session, Georgian Room, Hotel Statler. See Technical Program for papers.

8:00 p.m.

Electroplaters' Night at the Boston Pops, Symphony Hall, Huntington Avenue. A ticket in the Convention book may be exchanged for a ticket to this event at the Registration desk any time Tuesday between 10:30 and 7:00 p.m.

WEDNESDAY — JUNE 14

7:45 a.m.

Branch Secretaries' Breakfast—Parlor C, Hotel Statler.

Education Committee Breakfast — Cafe Rouge, Hotel Statler.

9:00 a.m.—11:30 a.m.

Fourth Educational Session—Georgian Room, Hotel Statler. Symposium on Mechanical Finishing. See Technical Program.

10:00 a.m.

International Fellowship Club Golf Tournament—Tedesco Country Club, Swampscott, Mass. Chairman: *Mr. Joseph J. Duffy, Jr.*, Pennsylvania Salt Mfg. Co. All handicap groups have a chance to win.

Bring your clubs and shoes! Arrange your transportation with the Committee. Adjournment to Clambake after the play.

1:30 p.m.—6:30 p.m.

Outing and Clambake—Thomson Club, Nahant Beach, Nahant, Mass. Buses leave Statler from Columbus Avenue door.

Softball game—East (Champions) vs. West.

Clambake at 5:00 p.m.—Wear your outing clothes!

A ticket to this event is included in the Convention book.

2:00 p.m.—4:00 p.m.

Research Committee Meeting—Parlor D, Hotel Statler.

6:00 p.m.

Research Committee Dinner—Parlor D, Hotel Statler.

THURSDAY — JUNE 15

8:00 a.m.

Combined Breakfast—Research and Education Committees—Parlor C, Hotel Statler.

9:00 a.m.—11:30 a.m.

Fifth Educational Session—Georgian Room, Hotel Statler. Research Reports.

2:00 p.m.

Final Business Session—Georgian Room, Hotel Statler.

7:00 p.m.—1:00 a.m.

Annual Banquet—Imperial Ball Room Suite, Hotel Statler.

Dinner—Golf Awards—Society Awards—Entertainment—Music—Dancing. A ticket to this event is included in the Convention book.

LADIES PROGRAM

CONVENTIONS of the A.E.S. are unique in that the ladies who attend always have the most fun. With historic and picturesque Boston for this year's scene of activities, and with Chairman *Manson Glover's* Ladies Committee working hard on the arrangements, the 1950 schedule for the entertainment of the fair sex promises to exceed anything that has gone before. The ladies will literally be whisked from one function to another, and therefore had better come prepared with an ample energy reserve to last out the schedule. Notwithstanding this, there will still be sufficient free time for those who prefer to investigate in their own way the unscheduled nooks and corners of the Hub City, Cradle of American Democracy, and one of the nation's most "atmospherish" attractions.

Something a little different will be offered the ladies at Boston in the way of an interesting technical session attempting to explain the "mysteries" of electroplating in a manner that will enable them to decipher the sleep-talking, falling hair epidemics, and strange moods of their harassed bread winners. Sightseeing tours, a visit to the exquisite Italian Renaissance former home of Mrs. Jack Gardner, and a special concert by the world-famous Boston Pops Symphony Orchestra are among the other attractions listed for the entertainment of the ladies.

A complete listing of the Ladies Program follows:

Monday — June 12

MORNING—Registration at Statler Hotel

Official Greeting to Founder Members and their wives at the Opening Session of the Convention

AFTERNOON—1:00 P.M.

Sightseeing tour to the historic spots of Old Boston, including Bunker Hill, Old North Church, the Statehouse, and many other famous and interesting landmarks of early American History.

Mrs. Anne Baker Love
Ladies Chairman

EVENING

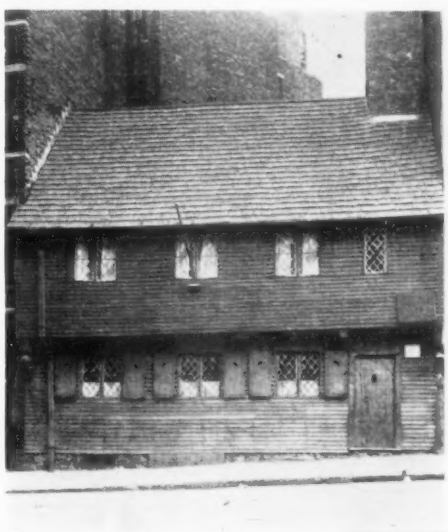
Open House Party at the Statler Hotel. Refreshments, dancing, entertainment, and awards. Courtesy of the International Fellowship Club.

Tuesday — June 13

MORNING—Open

NOON—12:30 P.M.

Guided Tour and Tea at the Wayside Inn, Sudbury, Mass. Courtesy of the *M. E. Baker Co.*



Paul Revere's home, one of the landmarks of Boston. A museum of his famous handwork in metals is now housed here.

EVENING—8:00 P.M.

Special concert of the Boston Pops Symphony Orchestra at Symphony Hall. Conductor Arthur Fiedler has promised an outstanding program honoring Electroplaters Night.

Wednesday — June 14

MORNING—10:00 A.M.

Educational Session and Demonstration—"Taking the Mystery out of Plating."

AFTERNOON—1:30 P.M.

Party at the Thomson Club, Nahant. *Anne Baker Love* and *Joan Trumbour Wiarda* will be your hostesses. Generous awards will be made. Clambake and Outing at the Thomson Club. All kinds of games and contests throughout the afternoon. A real old-fashioned New England Clambake that will stagger you into taking it easy all evening.

Thursday — June 15

MORNING

Nothing scheduled. Sleep as late as you like while hubby goes off to the salt mines again for the last Technical Session. A good morning for breakfast in bed.

NOON—12:30 P.M.

Aunt Ella Party and luncheon. All those who have attended before will welcome again *Dave "Aunt Ella" Clarin* with his masterful patter and entertainment. Sponsored by *Oakite Products, Inc.*

AFTERNOON

Open—Perhaps a session at the Beauty Salon in preparation for the evening's grand finale?

EVENING—7:00 P.M.

Annual Banquet, Dancing, featured professional entertainers, awarding of Honors, presentation of new Society Officers, etc.

Bunker Hill Monument, which stands across the Charles River from Boston, commemorates the famous Revolutionary War battle of 1775.

Old North Church, in whose steeple Paul Revere saw the fateful light that sent him on his famous ride through the Boston countryside.

International Fellowship Club

This year the International Fellowship Club starts its second quarter century of service and support to the A.E.S. and the plating industry, and in doing so will again sponsor the several social events that have become a highlight of all A.E.S. Conventions.

The Fellowship Club is made up of manufacturers, suppliers, and distributors in the metal finishing field, many of whom contribute to cover the expenses involved in assuring the conventioneers of a thoroughly enjoyable time.

On Monday noon, the I.F.C. will hold its Annual Luncheon and only meeting of the year. All representatives of manufacturers, distributors, and supply houses in the metal finishing industry are welcome. Election of officers will take place, but the principal purpose of the meeting is to have all suppliers meet for a friendly get-together.

Monday night, the Fellowship Club will again hold its Open House Party, open to all those attending the Convention. Refreshments will be served, and an orchestra will be provided for dancing. In addition, all those attending will be eligible for special awards.

Rudy Hazucha
President

George L. Nankervis
First Vice-President

A. P. Munning
Second Vice-President

Al Braun
Third Vice President

Louis M. Hague
Retiring President

T. A. Trumbour
Permanent Secretary

consisting of a complete set of Sterling silver tableware, a 6 pc. solid silver Tea Set, and numerous Government Savings Bonds.

On Wednesday, the Fellowship Club, in the person of genial *Joe Duffy*, will hold its Annual Golf Tournament at the beautiful Tedesco Country Club. All convention registrants are eligible to compete. A nominal Green Fee will be charged each entrant, and all entrants must bring their own clubs. Play is conducted on a special handicapping system that gives all players an equal chance to win the beautiful I.F.C. Golf Trophy, regardless of their golfing ability. If you don't believe it, just remember that last year's second place winner shot a 138 gross, and the fourth place winner grossed 137. *Jim Badaluco*, (of The J. C. Miller Co.,) the Sammy Snead of the plating industry, will be on hand to defend the title he won last year with a sparkling 82, which just *happened* to be both low gross and low net for the day.

The Golf Tournament will be concluded in time for those competing to attend the Clambake and Outing at Nahant in the late afternoon. Awards to the winners of the Golf Tournament will be made at the Annual Banquet on Thursday evening.

A special event for the Ladies will be held on Wednesday afternoon on the grounds of the Thomson Club at Nahant, scene of the Clambake and Outing. Awards will be made through the generosity of the International Fellowship Club.

Joe Duffy
Golf Chairman

In Memoriam

With the passing of Ernest Lamoureaux in November 1949, the International Fellowship Club, as well as the A.E.S., lost one of its most enthusiastic members and supporters. Active in the early affairs of both groups, Ernie helped write the constitution of the Society and served as the second Chairman of the Fellowship Club in 1926-27. He was an Honorary Life Member of the A.E.S.

The Fellowship Club extends to his family their heartfelt sympathy.

Joan Trumbour Wiarda
Plato Party Hostess

Metal Finishing in Argentina

(Courtesy of Pan American World Airways)

By Robert C. Bray*

ELECTROPLATING was started in the Argentine around the year 1900. The techniques employed were European and mostly derived from Canning & Co. of England. Later, German techniques were introduced. American products and techniques were introduced around 1937. Silver baths were the first used, followed shortly after by nickel and then chrome plating around 1925, and in the last two years by bright nickel.

Up to the year 1944 all plating in this country was purely decorative, but during the last war so great was the shortage of tools, tool steel, and special alloys that the electrolytic salvage of worn parts was started, and this was chiefly hard chromium. Due also to a total lack of nickel anodes, and there being adequate supplies of sulphate, several plating job shops manufactured nickel anodes.

Industry Statistics

There are in the Argentine about 1500 plating installations; 1300 of these in the city of Buenos Aires and suburbs, the remaining 200 spread out through the Argentine. Of the 1500, half are job shops, the other half are finishing departments in factories.

The industries in this country requiring metal finishing will be described briefly under separate headings.

Brass Sanitary Fittings

There are five big brass sanitary fittings foundries in the Argentine, four in Buenos Aires. One has a semi-automatic warm Watts nickel bath, the cleaning and chromium plating cycles being normal still operations. One has had an organic-type bright nickel bath in operation for about 2 years. Two others are now installing cobalt bright nickel. The rest use dull nickel baths. All metal sanitary fittings are bright chromium finished. The bigger producers turn out good quality work. There are many smaller foundries, but their installations are backward and the work turned out is very poor indeed.

Electrical Appliances

There are about eight electric iron manufacturers, all in Buenos Aires. Three or four produce electric kettles & toasters. None to date use bright nickel: all have warm Watts baths. The practice to date has been straight nickel on the base, and acid copper plus nickel on the top of the iron to give a brighter finish. One plant has recently installed a potassium high-speed copper bath. One of these electric appliance manufacturers is about to switch to cobalt bright nickel.

Cia. Arg. Industrial General Electric are just finishing their new factory and will have in their plating installation high-speed copper, cobalt bright nickel, chrome, zinc, tin and barrel plating. Their plant will be the most modern and up-to-date in the Argentina. The plating tanks are 400 gallons each. Their generator capacity will be 3000 amperes.

It must be borne in mind that no local manufacturer is big enough yet for full automatic plating plants. The internal market is too small. Heretofore all plating was done in room temperature baths. With the advent of high-speed plating, even though hand operated, production has been stepped up considerably.

Surgical Apparatus & Instruments

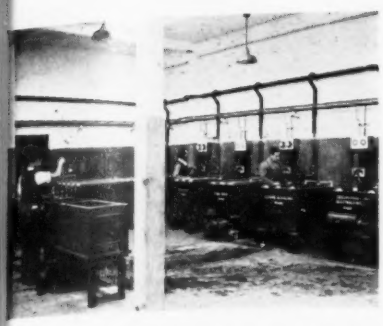
Production of these is not very high. There are three major manufacturers of surgical apparatus, two of which make instruments. A fourth is a large manufacturer of instruments only. Plating is carried out in room temperature bath. One of the first three (*Siemens*) "*Inag. E.N.*" is building a big factory and will be installing cobalt bright nickel.

Automobiles — Refrigerators — Stoves & Household Heaters

There is no manufacture of automobiles. Cars are imported and assembled locally. Chromium finished parts are received finished. The coachwork, once assembled, is phosphate coated and painted.

Refrigerators, stoves and household heaters are all built here, with the exception of refrigerator pumps, which are imported. Chromium finished parts are made and plated here in fairly up-to-date installations; that is, warm Watts baths, though one or two manufacturers will be switching over to bright nickel soon.

*Electroplating Division — Duperial S. A., Buenos Aires, Argentina.



Plating room for zinc die castings at Inyecta Argentina S. A.

These commodities are mostly phosphate coated and given a lacquer finish. Tricloroethylene degreasing is extensively used in these installations. For example, *Cia. Argentina Industrial General Electric* in their new plant have a complete dip phosphate installation for all sizes of refrigerators. The paint spray booths and drying ovens are the last word in modern painting equipment and the whole system runs on an overhead monorail.

Local manufacture of zinc die-castings for automobile spares and refrigerator parts is tolerably good, and the chromium plating of these has improved considerably. *Inyecta S.A.*, a zinc die-casting manufacturer, has a large plating section. The chromium finishing there is very good.

Telephone and Radio Parts

Standard Electric, *R.C.A. Victor*, *Philips*, etc., have their local factories, and their plating and finishing is in general run on the lines of their parent companies.

Very little cadmium plating is done, due to difficulties in importing this metal. Bright zinc plating is the usual finish given to radio chassis and parts. Gramophone record matrices are made locally in several up-to-date plants.

Standard Electric has the biggest plating plant for electric parts. They zinc, tin, copper, nickel, silver, and gold plate. This firm also manufactures selenium disc rectifiers for plating and other uses.

Anodizing

Decorative anodizing of aluminum was started in the Argentine about 15 years ago, by *Fred. Sage & Co.* A very high standard of quality has been maintained and other anodizers have had to follow suit.

Galvanizing

Import tariffs on galvanized products coming from abroad protect the local galvanizing industry. Corrugated sheets for roofing and pipes are manufactured and dip galvanized. Pipe connections are mostly imported from Europe, and are electro galvanized locally. There are many fairly big job shops here who only zinc plate. Hardly any of the zinc baths are of the acid type.

Tinning

Tinning done in this country is mostly small work for electric refrigerators, stoves, and to a certain extent cooking utensils.

Electrotinning (stannate bath) is the one in biggest use, and used almost primarily for copper cooling coils on domestic refrigerators. Grids for same are dip tinned. There is no tin plate manufactured here; all tin plate for the canning industry is imported.

Die Castings

The manufacture of zinc die-cast parts has improved considerably over the past 5 years. The pioneers in this country were *Inyecta Argentina*. They brought out Swiss machines and technicians and in about 1½ to 2 years they were producing a first class die casting.

Aluminum die castings are beginning to appear on the market now. Zinc die-castings are given a good chrome finish on dull nickel and high speed copper. Aluminum die-castings are given zinc immersion followed by copper, nickel and chrome.

Railway Parts

None of the railways in this country have a good, fully-equipped plating shop. They do some maintenance work, but a good deal is farmed out to job shops. The railway plating shops as yet do no specialized plating such as building up worn-out parts with nickel or chrome. They just do plain decorative work.

Hard Chrome and Hard Nickel

For a good many years now hard chromium plating has been done on dies. The use of heavy chromium deposits is increasing and so are the plants capable of doing a good job. Heavy deposits of nickel have not as yet gone beyond the experimental stage.

Costume Jewelry

There are any number of small, but few big manufacturers of costume jewelry. The trend in fashions partly follows the States, partly the European. The plated finish of these articles is very sketchy indeed. The plating installations are small and inadequate for the production, which consequently brings on rush jobs insufficiently coated. Gold plating has been the most popular finish, with red to green variations in tone. More recently rhodium plating has come to the fore.

Phosphate Coating

Electric refrigerators built here are nearly all phosphate coated. Soon all manufacturers of these commodities will be using it. Metal furniture manufacturers have not as yet gone beyond sanding, before painting. The black phosphate coating is extensively used by motor-car spares manufacturers.

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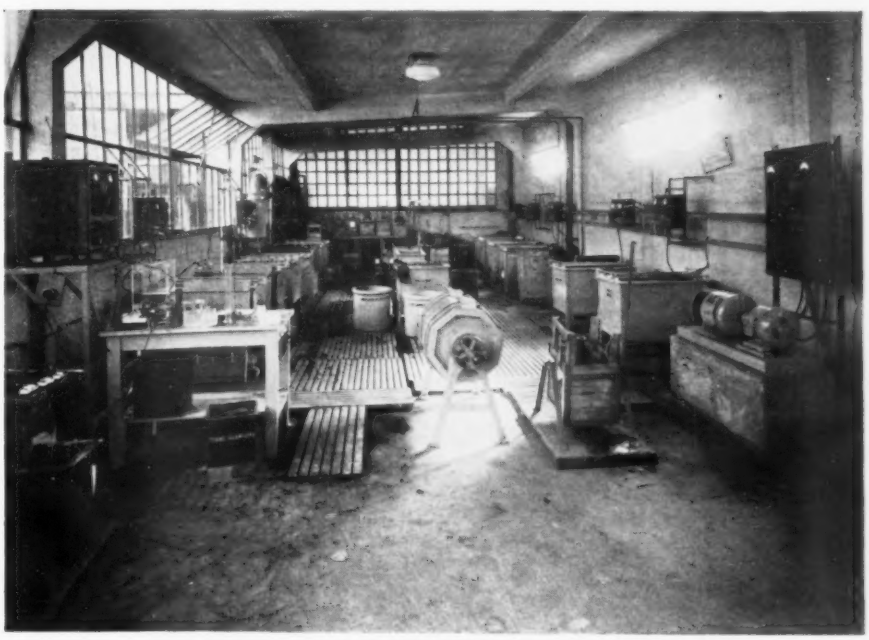

Demonstration plating laboratory of Duperial, S. A., Buenos Aires.

(Courtesy Australian News and Information Bureau)

Bridge and Harbor at Sydney, Australia.

Australia

By J. J. Dale*

AUSTRALIA is a young country of relatively small population (about eight million) and large distances (about 2,500 miles wide and nearly 2000 miles from north to south). Because only a relatively narrow coastal belt is adequately watered, practically the whole population is necessarily concentrated in this region, mainly on the eastern and southern sides of the continent. Quite unnecessarily, however, the greater proportion of these people are further concentrated into the six large state capital cities, of which Sydney and Melbourne—with populations of 2 and 1½ millions respectively—rank among the larger cities of the world.

A brief survey of the economy of the country will give a background on which to view the status of its plating industry. The present generation is seeing a changeover from the predominance of agricultural or primary activities to an almost evenly balanced economy in which the value of secondary production at the moment just exceeds that of primary production. Manufacturing industries in Australia, by no means weak before the war, were firmly established in the country's economy by the relatively tremendous wartime demand which they were called upon to meet. Urged on by dire necessity, Australian firms proved to themselves that they were able to manufacture items previously considered impossible. Such things as optical instruments and aircraft are still being made, and a healthy young automobile industry has grown up since the war. Corresponding with this increase in the stature of the manufacturing industry as a whole, the electroplating industry has also grown in size and importance.

Industry Statistics

Official statistics on the plating industry cover only work done by the jobbing plants or factories devoted entirely to electroplating. At least as much work again is done in plants attached to manufacturing firms who finish their own products. From the published figures it is estimated that the value of production in the electroplating industry is about 0.5 per cent of the total value of production of the secondary industries. Contributing to this are some 600-700 plating shops (depending at what size of "shop" you stop counting), of which some 500 are in Sydney and Melbourne, the remainder being chiefly in the capital cities of the other four states with one or two in each of the larger provincial cities. The total number of persons employed in the trade would be at least 6,000-7,000, so that the average plant employs ten persons (as an item of interest these figures mean that about 1 person in 1,200 in Australia is connected with the plating trade. Size of plant varies widely from quite small jobbing shops staffed by only 3, 4 or 5 men up to larger plants with staffs of about 50. The average wage per employee in 1946-47 is given as £327 p.a.—but, when allowance is made for a considerable number of females and juniors, the adult male wage would average more like £400. On American standards, these wages are low. For example, only a minority of Australian workers can own an automobile, the cheapest of which costs £600-800.

Sydney and Melbourne contain the largest proportion of jobbing shops, whilst Adelaide, a newer city industrially, has a greater proportion of plants attached to large manufacturing concerns, with the emphasis on automobile work. Other than this, the type of work done in the plants is much the same as that done in other countries, there being no well-marked centers for certain types of plating (as, for example, Birmingham and Sheffield are noted for silver plating in England). Firms served by the plating industry would be much the same as in any country, with the auto and cycle trades very prominent, builders' hardware and household goods making up most of the remainder. In addition, there is quite a sizeable silverware trade.

Types of Plating Done

The recent war had very profound effects on the type of work being done, and on the methods employed. Because of the tremendous demands of war supplies, decorative plating was to a large extent set aside and replaced by protective cadmium and tin plating.

*Defense Research Laboratories, Maribyrnong, Victoria, Australia.

Automatic bright nickel plating of automotive parts at G. M. Holdens.

In addition, the amount of hard chromium plating done was increased very considerably, most of the work being on new production. It must be remembered also, that salvage was of much greater importance in Australia, where spare parts for machines and equipment were often unobtainable. When the war ended, the demand for hard chromium plating decreased to a large extent, but wartime education of both platers and users is never quite lost, and a number of jobbing plants are now specializing in this work. Hard chromium plating also has a permanent place in plants attached to large manufacturing and engineering firms. Other plating practices in Australia which virtually owed their foundation to wartime demands included anodising of aluminum, rhodium plating of mirrors, and thick plating with precious metals for special electrical work.

Polishing and Buffing

Australia has not escaped the world wide epidemic of polishing headaches, and this department is the acknowledged bottleneck in nearly all plants. (A feature of the local set-up is the large amount of polishing work sent out from plating shops to polishing contractors). The position has been partly alleviated by modernization of equipment, such as by installation of backstand idlers; nevertheless, platers are turning to the latest techniques aimed at decreasing the amount of manual polishing in the plating cycle.

Bright Plating

Bright plating processes, and to a lesser extent periodic-reverse current plating and electropolishing, are being utilized on an expanding scale. Bright nickel plating has caught on in a big way in recent years and a large scale change over from dull to bright plating is now taking place. Many platers got their first experience of bright plating with the cobalt-type bath which is still used with success, but a really spectacular change-over has occurred in the wide-spread introduction of the modern organic-type solutions.

Bright copper baths are being installed in a few plants, and other modern baths such as high-speed copper and high-chloride nickel are also coming into the limelight.

Special Processes

Periodic-reverse current is arousing considerable interest in Australia, and a number of timing devices are on the market. These are mostly used for silver plating operations. The benefits obtained from electropolishing are also receiving attention, but to date the commercial use of this process is almost entirely confined to stainless steel fabricators, for whom it is dong a first class job.

On the mechanical side, we are seeing the installation of automatic plating equipment where production warrants it, although these situations are naturally somewhat limited. A large and impressive plant has been installed to do automobile work at the Woodville Factory of *General Motors Holden Ltd.* (makers of Australia's locally produced automobile, the Holden).

The very important matter of waste disposal is just beginning to engage the attention of local authorities, and platers are now finding themselves compelled to make adequate provisions for this important detail in their plants.

New overseas developments in plating are not as a rule immediately adopted in Australia; a period of several years may elapse before they are taken up. Several factors are responsible. Published accounts will not sell processes as effectively as demonstrations, which are made nearly impossible by the isolation of the continent. The financial situation and its consequent dollar restrictions largely prevent the importation of many of the materials developed in America for use in modern plating practice. Again, in Australia there are very few technically trained men who have specialized in electroplating, and who can assist platers with the introduction of newly developed processes from overseas; technical help is not always available on immediate call. It has taken some little time also for some of the Australian platers to appreciate and apply the far greater amount of care and control required for many of the latest processes. The general standard of technique and control has, however, advanced considerably in recent times and Australian platers are, in the circumstances, reasonably well abreast of the times. World War II was responsible for much of this improvement in the general standard of Australian electroplating. The requirements of the armed services, praticularly in the case of air-

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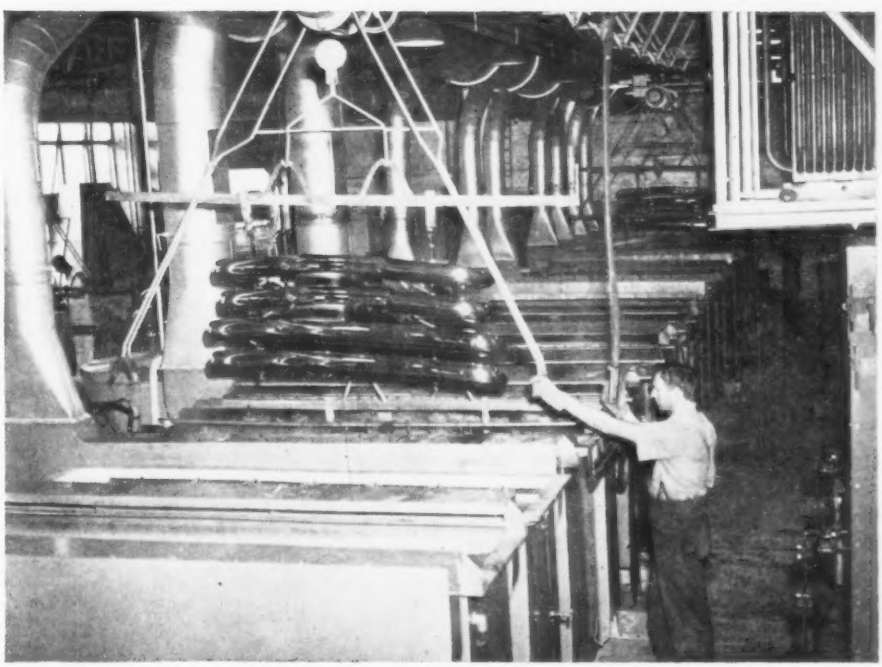

Bumper bar plating line for copper-nickel at the G. M. Holdens automobile plant.

Brazil

By Alberto Paulo Ribbe*

Night view of Sao Paulo, Brazil, one of South America's most modern cities.

TO give a picture of the present situation of the metal finishing industry in South America may be best accomplished by telling the story of Brazil's. The reason is a simple one. South American countries have their industrial development, as a general rule, still strongly overshadowed by a predominantly agricultural tradition, which may be more or less intense for the one or the other in comparison to its neighbors, but which continues to distinguish their economic life. In Brazil we find that about 57% of its working population, out of a total of 20 million, is engaged in agricultural activities, some 3% in ore or minerals extraction, and only about 8% in industry. Industrialization has started, however, and is going noticeably into a steady acceleration, particularly observable during the last war and considerably aided by the overwhelming exchange difficulties with its main foreign suppliers. To state an example, the first Brazilian census (1907) showed a total of 3,205 enterprises, employing 150,000 workers. During the first World War, 1914-1918, an increase of 6,000 enterprises was registered, and the census of 1920 showed the existence of a total of 13,500, attaining in 1940 the figure of 50,000. Data for 1948 indicate 75,000 with some 1.5 million people employed. The early figures cannot be taken, however, in a strict sense of industrialization, as those investments were all small sized, with a predominant artesan activity, or one directly resulting from, or connected with, the processing of agricultural goods. This latter, representing about 27% of industrial production in 1927, rose to 40% in 1920, so that the most important characteristic of this phase is the absence of a heavy industry; in other words, Brazilian industry depended a great deal on importation, since no machines, tools or accessories were being produced then.

Today, manufacturing is distributed chiefly among the following: clothing 27%, food processing 18%, metal-working 11.4%, hides and leather 8.2%, civilian construction 7.1%, furniture 5%, chemicals 4.7%, ceramics 4.4%, these figures representing occupational allotment of labor.

Geographically speaking, about 67% of Brazilian industrial production and 55% of labor is concentrated in the central state of Sao Paulo and the neighboring federal district, the seat of the capital, Rio de Janeiro. In spite of this relatively heavy concentration, there is occurring, in recent years, an expansion of heavy industry into other regions, including the traditionally agricultural North. This is especially true for activities connected with metal working.

A basic requirement towards the development of metal working industry is iron and steel production. There are some plants, the largest of which are the *Campanhia Siderurgica Belgo-Mineira* and one scheduled to produce in the near future 1.4 million tons and whose output in 1949 was almost 600,000 tons of steel. This is the famous *Companhia Siderurgica Nacional of Volta Redonda*. Its production schedule includes iron and steel plates, plates for naval construction, rails, bars, girders, and, for the first time in Brazil, tin plate. By-products such as pitch, benzol, naptha, ammonium sulphate and chemical fertilizers are supplying the chemical, pharmaceutical and munitions industries, as well as agriculture. Projects which are related to Volta Redonda and in progress include the mechanization of coal mining, coal washing and treating plants, electric generating stations, etc. This is a pleasing expansion, maintaining very reasonable prices, so that the fundamentals for a solid metal working industry are present. The absence of good quality fuel of its own, the dependence upon foreign machinery, the lack of skilled labor, and, last but not least, the weakness of Brazilian private capital, are the embarrassing factors to production. These are perhaps the main reasons that prices are so high compared to imported goods. But even now, in a sizable part of Brazilian industry, a sudden opening to unrestricted importations would be a deadly stroke. This is especially true in those branches which manufacture small utensils and where decorative finishing practices find their main application.

It is only natural that progress in finishing comes after progress in manufacturing: American industry witnessed this phenomenon itself. At present, while modernization of production is spreading, an important reaction can be felt in finishing as well. Not only because industries set up with American aid during the war had their influence, foreign investments (General Electric, etc.) and the appearance of

*Chem. & Met., Superint., Finishing Dept., Comercial e Industrial de Fornos Werco Ltda. Rio De Janeiro, Brazil.

small shops [illegible] by Europeans doing good finishing, exert their influence and are introducing modern ideas to the business. It is being understood, slowly, that nickel and chrome plating is not only desirable because it makes an article look nice, but also that it has a certain function to fulfill in a good many of its applications. An interest for causes of failures is apparent, very much like the one which kept foundrymen busy when casting failures became a handicap when compared to better quality of new competitors, who brought their technical know-how from abroad.

The problem of corrosion is getting increasing consideration and several institutions are preparing to give it the same careful study and attention they have and continue to give to metallurgical questions. They are finding now, in the field of metal finishing, not so stubborn an opposition which they had to face at the beginning, but instead an audience which is more eager to learn.

The *Instituto de Pesquizas Tecnologicas* of Sao Paulo is certainly the one to be credited for a good deal of the latest Brazilian development in the metallurgical field. Keeping an up-to-date pilot plant, it went in for steel, both constructional and tool, cast iron and non-ferrous metallurgy, contracting foreign experts and sending men of its own to the United States and other countries, so that it became a stronghold of modern techniques, which are made available to existing national plants. This lead to the development of specifications and it is clear that this Institute, as well as its similar in Rio de Janeiro, the *Instituto Nacional de Technologia*, both now in the field of corrosion and its prevention, will do an equally important work to the benefit of the metal finishing activities. It ought to be mentioned in this connection, that *Dupont* is running a small pilot plant in Sao Paulo especially devoted to the demonstration of sound practices in electroplating and shop lay-out. Even so, much missionary work is to be done before production and finishing go hand in hand as in America.

Perhaps the most important feature of the actual situation is the interest in phosphatization and prefinishing practices. The latter especially because the heavy labor burden in selling prices is very painfully noticed. Tumbling techniques are meeting considerable interest.

Anodizing has been little known; little of it has been done before the war. One of the first to introduce it as a practice was the plating outfit of the Brazilian Airplane Engine Factory (Fabrica Nacional de Motores), built during the war under Lend-Lease facilities, which is now chiefly engaged in airplane engine overhaul for private commercial air-lines. Military aviation is depending upon two shops, one in Sao Paula and one in Rio, still not in full operation. A very recent and promising start is the anodizing layout of the *Laminacao Nacional de Metais*, in Sao Paulo, for decorative purposes, and a small shop in Rio de Janeiro making window screens.

Phosphatization is being practiced on a very small scale. It is being done in the above mentioned airplane engine factory, which has taken up the fabrication of trucks, and in a very modern way by the *Ford Motor Co.* in Sao Paulo, which processes the cars of their assembly line in a good sized spraying tunnel. Phosphating is going to be introduced by *General Electric*, in Sao Paulo, in its electric motor factory, and it is a trend of Brazilian screw and bolt manufacturers in general.

Hard chrome plating is finding its way also to Brazilian manufacturers. As a routine, so far it can be encountered only at the mentioned airplane engine factory in connection with engine overhaul and in two record factories located in Sao Paulo, where its introduction is also of recent date.

Electropolishing does not seem to have transposed the experimental stage. Efforts are being made by a tableware manufacturer in Sao Paulo, but lack of homogeneity of the available stainless steel has not allowed much progress.

Mechanical polishing, on the other hand has not seen much development. Greaseless compounds are not known so far. Belt polishing is being introduced at last, and there is already some interest on automatic polishing and buffing machines.

Metal spraying is also done in a very small scale, and where salvage is the purpose, it is going to enjoy a pleasant future, as accessories and spare parts are always scarce, and especially now almost unobtainable. Just recently a French enterprise has been founded devoted exclusively to metal spraying, and the *Wall Colmonoy Corp.* is also entering this promising field.

Porcelain enameling is widespread. *Ferro Enamel* is producing frit and compositions locally, and its production seems to be far behind actual demand, perhaps owing to importation difficulties of certain raw materials, especially clays for which Brazilian sources have not been found as yet.

There is not much to be told with respect to organic finishing. All the important American manufacturers are represented either through branches of their own or agents, and there are already some national manufacturers. Practices of course, cannot differ from the American, except for previous preparation of the basis metal. Synthetic enamels meet considerable interest.

Speaking most generally, the job plating shops are rather old-fashioned. Only a few months ago a good modern shop has been founded in Sao Paulo, for jobbing purposes exclusively. It is run by French operators. With very few exceptions, chrome plating excluded, baths are operated cold. Bright plating has been attempted, but was seriously handicapped due to scarcities of materials at first. There are very many small shops to be found, chiefly operated by Italians, and many times run by members of the family. They do mainly copper, nickel, chrome, and silver plating. Bright zinc and cadmium plating dates from the war period and has been little spread, the latter owing to its almost unbearable price. But it may be forseen that the next years will bring progress in this field, in analogy to the phenomenon observed in the casting industry during the war.

The bulk of these enterprises work with ready-made bath compositions, the chief source of same being English suppliers. Of the important American suppliers, only *Hanson-Van Winkle-Munning* has been represented for very long. *Daniels Plating Barrel* has started now; The *Rotofinish Co.* has a manufacturing agent; *Udylite* has contributed with the important lay-out of the Brazilian Airplane Engine Factory. However, modern practices require, as already mentioned above, much missionary work to be done, especially with the small job shops. The chief types of plating are performed with cold and inefficient baths, but the viewpoints on the cleaning cycle are still worse. Its outstanding importance is not yet known broadly, a fact that is painfully experienced by the few man-

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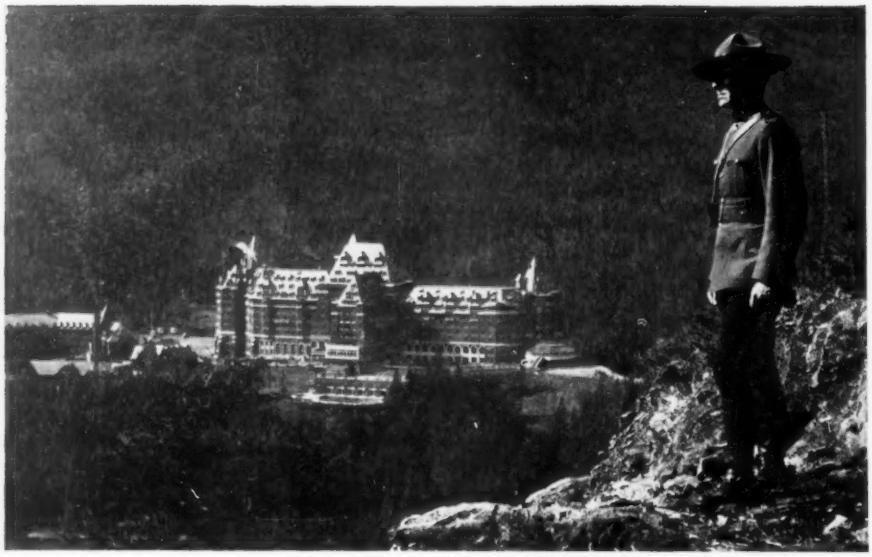


(Courtesy Canadian Pacific Railway Co.)

Canada

By A. C. West*

TRADITIONALLY, Canada has lived in the technical shadow of the United States. Having only one-twelfth the population, Canada has been slower to develop mass production industries and cost reducing techniques than her great neighbor to the South. Then, too, many Canadian manufacturing firms are associated with companies in the United States which have frequently advised them on major technical matters. This situation had developed a rather conservative attitude in Canada as regards gambling with new products and processes. Instead of taking bold action, many Canadian companies preferred to wait and see what happened in the United States.

Then, in 1939, came the war. Canada, as the first country on this continent to enter the war and start producing war waterials, found many problems facing her. Great Britain was able to help Canada decide what to manufacture and to give much advice on how it was to be made, but many production problems had to be solved quickly and Great Britain was far away. Canadian industry deserted its traditional caution and by experimenting, inventing and improving solved these problems magnificently. This new approach worked so well that the experience ushered in a new and more progressive era in Canadian technical development.

Although Canadian industry will always, in the foreseeable future, look to the United States for many technical advances, it now appears that Canada has developed to the stage where industry will show considerably more independent thought and will adopt promising new ideas more promptly than it was formerly willing to do.

What has been said above about Canadian industry in general applies also to electroplating in particular. Take bright nickel for example. Before the war new processes such as bright nickel plating got a lukewarm reception from most Canadian plating firms. Immediately following the war, however, there was a rush to bright nickel that surpassed all expectations. Similar has been the postwar Canadian attitude toward all new processes and equipment in the field of electroplating.

Applications of Electroplating

The applications of electroplating in Canada are much the same as in other countries. The automotive industry is the largest user of electroplating but other very important fields are found in the well established electrical appliance, plumbing and building hardware, metal furniture and silverware industries. In addition, we have an active and progressive graphic arts industry and a growing field is provided by engineering applications of electroplating.

Plating Processes

Most of the nickel being deposited in Canada today is of the full bright or semi-bright, easily-buffed type. In copper plating, the familiar Rochelle salts bath has been very popular, but high-speed copper plating processes are now being forwarded by an increasing number of industries. Bright plating processes dominate the zinc and cadmium plating field and much of the zinc plated work is given a brightening and passivating treatment in order to improve its appearance and prolong its usefulness. In chromium plating, the standard sulphate type bath is practically universal but there are several installations of the new SRHS process. In general, silver plating technique follows conventional lines.

Variety Complicates the Picture

One characteristic of Canadian plating plants is the wide variety of shapes and sizes of parts that must be processed through one plating line. Because the volume of production of metal articles in Canada is much smaller than it is in the United States, industry cannot possibly sub-divide and specialize to the same extent. To give an example, *General Motors of Canada, Limited* of Oshawa, Ontario, manufacture Chevrolet, Pontiac and Oldsmobile motor cars and Chevrolet and G.M.C. trucks as well, all in the same plant.

Many other examples could be given but a few will suffice. For instance, automobile bumpers for all makes of automobiles manufactured in Canada are finished in two bumper shops. Also, one Canadian plant that is engaged in the plating of zinc-base die-castings has to handle almost three times as many different shapes through one plating line as their associate company in the United States.

Thus, variety complicates electroplating in Canada and creates production problems additional to those existing south of the border.

Canadian electroplating industries have been moving steadily in the direction of full automatic buffing and plating equipment in recent years, but

*Assistant General Manager, Canadian Hanson & Van Winkle Co., Ltd., Toronto.

Because of the variety of work that must be processed, they often have to avoid equipment that is too highly specialized.

Metal Cleaning

There has always been a great deal of interest in Canada in the cleaning of metal prior to plating, but this interest has never been so intense as it is today. Solvent and vapor degreasers are widely used for precleaning and many automatic degreasing machines have been installed. Solvent precleaning has largely changed the nature of the alkali cleaning problem. In many cases the major job is no longer the removal of oil and grease; the chief interest is directed to the removal of buffing compound residues and the conditioning of metal surfaces to receive an adherent electroplate. Much progress has been made along these lines and further development work is in process.

Industrial Applications of Electroplating

In Canada, the applications of electroplating are, for the most part, not unusual, but the job being done by one company is worthy of special mention. *The Union Screen Plate Co. of Canada, Limited*, of Lennoxville, Quebec and Montreal, Quebec, is one of the firms doing outstanding work in the field of industrial and engineering plating, and this company makes their contribution to almost every industry in Canada.

They try to do more than a mere plating job. Their representatives actually make a careful study of the problems involved and conditions under which a part is to operate, before making a recommendation on the most suitable industrial plating for the application.

Specification Plating

Canadian companies that do electroplating and those that buy electroplated articles are becoming more conscious than ever before of the importance of plating specifications, especially as regards the thickness of the deposit.

A vigorous educational campaign is being carried on by the various Canadian branches of the *American Electroplaters' Society* and by the companies that are vitally interested in electroplating. These groups realize that in electroplating we have an industrial process which, if properly applied, will create the maximum value at the minimum cost. However, electroplated finishes have, in certain cases, been given a bad name because plate thickness has been sacrificed in order to reduce cost. It is felt that only by eliminating this short-sighted policy through the education of the buyers of plated ware, can the electroplated finish achieve and hold its rightful competitive position opposite other finishes.

(Courtesy Canadian Pacific Railway Co.)

Canadian Parliament Building, Ottawa, Canada.

BRAZIL

(Continued from page 79)

ufacturers of zinc-base die-casting. Semi or full automatics are not used as yet. Degreasing in petroleum solvent is common practice, together with soda lye scrubbing. A limited number of shops have alkaline electrolytic cleaners, an outnumbering proportion of them working cold. Modern cleaning machines are unknown, except for one set-up in Sao Paulo, *Industria Mecanica Novitas*, which is building a system for spray-phosphatizing of window screens, both aluminum and steel. This is the signal for quick adoption by other manufacturers because Brazilian industry is very competitive.

In concluding this discussion, which was intended to give a picture of Brazilian conditions as an approximate example of what the South American situation looks like, it is reasonable to state that with efficient engineering service and technical assistance, with the building of pilot plants such as that of the Institute de Pesquizas Tecnologicas and the Institute Nacional de Tecnologia, with the erection of modern facilities at shops run by the government, as for instance at the gas mask factory of the Army, a decisive step will be made in leading the metal finishing industry towards successful accomplishment of its purposes. The initial installation of an up-to-date shop for electrotyping of paper currency printing plates at the Brazilian Mint ought not to be forgotten at this point. For the moment, one important thing is being missed — the free exchange of technical experience either through conferences or publications, which is one of the most lasting impressions any Latin American gets in the United States, and for which American production men's organization are very much to be congratulated.

ARGENTINA

(Continued from page 75)

Paints used on refrigerators and cars are manufactured here, but to U. S. standards and specifications.

Summary

Metal finishing here today is following the general trend of the U. S., but is seriously handicapped not only by shortages of end-use products, but also by raw materials with which some end-use products could be made. Despite this, the quality of the locally manufactured products has improved tremendously in the last four years.

(Courtesy British Overseas Airways Corporation)

China

By C. C. Wong*

THE free port of Hongkong has gone a long way toward industrialization in the last twenty years. Its geographical and political position confines its business activities to the import and export trade, and thus practically all industries are grown out of and established for the import and export trade. As a result of this peculiar development, Hongkong's industries are expressly for processing imported raw material into finished or semi-finished products for re-export. Thus, rubber from Malaya and canvas from London are manufactured into rubber shoes for export to London and Malaya; annealed wire from New York is drawn and made into sewing needles for export again to New York. This situation explains why Hongkong's industries are not inter-related, as in American cities; too often production is stopped due to machinery break down or perhaps due to a shipment of raw material being overdue. Sometimes a factory even has to shut down completely because the countries that supply their raw material restrict its export to the Far East. With this in mind, many manufacturing methods described here that may seem at first insufficient or only make-shift can be understood. Nevertheless, Hongkong's industries are still healthy and earning high profits; among them metal finishing ranks about fifth as regards the number of people employed. It can be divided into two main groups: (a) polishing and electro-plating, (b) enameling.

*Manager, Kam Wah Hong, Hong Kong, China.

Plating Equipment

It was thirty years ago that a small group in Hongkong was interested in electroplating as a hobby. A dry battery cell, small pieces of nickel plates, nickel salts and beakers were among the apparatus they used. Gradually, 3 small shops were set up by the more successful hobbyists. These did odd jobs of re-plating hardware, plumbing and tableware. As was true with most infant industries, these shops were struggling along, and barely managed to meet expenses. Their great chance came when flashlight factories began going up. When the war started in 1939, British and European manufacturers were too busy on war jobs, leaving the Far East market to the relatively peaceful, booming Hongkong. Flashlight, lantern, and vacuum-flask factories were increasing in numbers and humming day and night. These factories all require electroplating. Their prosperity meant more and larger electroplating factories; until the Japanese occupation after Pearl Harbor the industry had about 40 plants. The whole industry almost closed down during the occupation. At that time whatever small amount of work there remained was done by a few; they had to generate their own electricity with producer-gas engines, using coke as fuel. Nickel coins were used as anodes. After V-J day the industry did not recover from the disruption until the latter part of 1947. The post-war boom everywhere did not leave this industry out, until today it is the largest electroplating center in South China, totaling 150 plants large and small employing 1,000 workmen.

Finishing Operations

The average run of shops consist of polishing, buffing and plating departments. Polishing wheels are made from cotton remnants, 8″ dia., and abrasives glued on with animal glue. Lathe speed runs about 2,800 to 3,000 r.p.m. Plumbing and hardware made of castings are being polished before buffing, and articles fabricated or stamped from inferior brass sheets also have to be polished before buffing. Buffing wheels are made from cotton remnants, both full-disc and sewed pieced. Little attention is being given to buffing wheels, with the result that none are suitable for coloring or efficient cutting purposes. Wheel sizes are 6″, 8″ and 10″ dia. and wheel speed 2,800 to 3,000 r.p.m. Brass and aluminum stampings from the better quality sheets are buffed directly without prior polishing. Both cutting and coloring are done in one operation to remove tool marks and give a smooth surface for plating. For work of more intricate contours, a hand brushing operation is added to remove the buffing dirt. Cleaning is done in heated caustic solutions. Tanks are metal containers of every description. After cleaning, the work is immediately nickel plated. Plating tanks are welded steel construction lined with two or three layers of tar. Usually the tanks are not large enough for the amount of work done, and no agitation is employed. Each shop has to generate its own D.C. supply using motor-

Polishing shop in Hong Kong. Note the rock used to hold the lathe steady.

generator sets. Generators deliver 250 amp. to 1,000 amp. at 8 volts. Nickel anodes used are rolled depolarized, both in elliptical rod form and in plate form. After nickel plating the parts are dried with an absorbent powder. The plated parts are then polished on a leather wheel with white lime compositions. Most shops do not have exhaust systems, and those that have are inadequate.

The bulk of the work is in plating for the flashlight industries. This represents about 75% of all the work, with lanterns, aluminum ware, vacuum-flask, hardware and miscellaneous industries taking up the remainder of the plating capacity. For flashlights, lanterns and some hardware the final finish is nickel, while some better products are chromium plated. For aluminum ware utensils, and vacuum flask caps, usually the final finish is polished and buffed. Some of the lanterns are tin plated. Gold and silver plating is limited to jewelry work. Almost ninety per cent of the plating work is on production runs, while the remaining ten per cent is jobbing and repair work. There are sometimes quite a few interesting jobs in the latter category where some ingenuity is required for work that is too large for their existing equipment. Auto bumpers, long bars, and some furniture frames are often the headache of smaller jobbers who have to rig up a temporary wooden tank to hold the job. In one case a large Lion trade mark had to be chromium plated. During polishing and buffing, instead of placing the work against the wheel, two workmen, being without even a hand crane, had to lift up a single-end polishing lathe to buff the work, like snagging foundry casting with a flexible shaft grinder. The piece being too large for the plating tank had to be plated on one end first and then the other end.

There are in all about 700 polishing lathes, single and double end, in the plating industry. The average workmen can buff and color about 300 (new style) or 450 (straight shank, old style) flashlight bodies per day. This is rather slow compared to machine production of 500 per hour. However, last year it plated about an average of 30,000 per day of flashlights alone. The industry's production is highly seasonal, with slack season from March through July, and peak load around the end of the year. A small percentage of the men are laid off or work part time during slack seasons, and extra help is employed working 24 hours during rush seasonal shipments. Although new plating shops are still going up, the capacity of the industry is already in excess of demand. Last year's figures of the sale of plated products was only one quarter of those of 1948 and 1947.

Labor Situation

Among the requirements attributable for the industry's coming into being are Hongkong's position as a free port and also cheap labor. One good example is the case of manufacturing wrist-watch bands, using left over brass sheets manufactured and highly polished in Hongkong. These are then shipped to the United States for plating (an operation where mass production and uniformity is of decided advantage) and packaging and distributed for sale there or re-exported back to Hongkong again. Most of the workmen in the larger shops are on a monthly salary basis, with bonus for work in excess of the standard rate, and time-and-a-half pay for overtime. For the smaller shops a large percentage of the workmen are paid on a piece-work basis. One peculiar practice here is that the buffing compound used in buffing is charged to each workman and deducted from his weekly pay. The average workmen draw about the same pay along the social pay scale as the American workmen i.e., better than the school teacher and the white collar class. Most shops take on apprentices, not with the idea of putting them through an apprentice school, but as a means of obtaining cheap labor. The apprentice is supposed to pick up whatever he can while working there, and after three years he would become a full-fledged workman. While serving their apprenticeship they receive free lodging and meals, but hardly any pay the first and second years, and one-third of a workman's pay the third year.

Except for a few large shops, working conditions of the industry as a whole are poor. Often there is insufficient floor space. Lighting is inadequate, adding to the dimness already due to dusty atmosphere and dust-covered walls and floors. Most shops do not have an exhaust system or dust collectors. The few that have them are improperly designed. The workmen do not use any respirators to keep away the dust, with the result their health is being impaired. Regardless of the living standard or wages, the health of the workmen should be protected and working conditions in this industry should be greatly improved. Fortun-

(*Continued on page* 111)

(*Courtesy British Overseas Airways Corporation*)

Street scene in downtown Hong Kong.

(Courtesy Pan American World Airways)

England

By Dr. S. Wernick

Consultant - Secretary of Electrodepositors Technical Society

DURING the post-war period, trends and developments in the metal finishing industry of Great Britain have been much influenced by the economic and political pattern of the country. The war period naturally exercised a profound effect on the industry by directing the class of finish into the protective, rather than the decorative field: chromium as a decorative finish largely disappeared, while the use of zinc and cadmium plating expanded correspondingly. Decorative nickel plating gave away to a significant application of heavy nickel deposits employed in building up worn or undersized armament components. Curiously enough, rhodium plating, which had hitherto been used sparingly as a jewelry finish, came into its own as a valuable tarnish-free finish for the surface treatment of electrical, radio and radar components. All this naturally necessitated the production of new plant in considerable quantity, and expansion in the anodizing of aluminum finish for aero components as well as other protective finishes considerably increased the total metal finishing plant in Great Britain, which by the end of the war had reached a surprisingly high peak.

With the war over, it was at first thought that much of this new plant would become redundant. To a certain extent this did occur, but in general, most of the plant has been re-directed to alternative metal finishing applications, and in particular to those industries which have found it essential to expand their metal finishing activities as a result of the heavy demand for badly needed goods of all kinds to replace the wastage of the war years.

This country's economic condition following the war, as is well known, was profoundly changed, primarily through the loss of our British overseas investments which were swallowed up to finance the war. Today, probably the biggest factor in industry is the emphasis on the export drive, whereby the country is straining all resources to manufacture on a sufficient scale to pay for its imports. The country's economics has resulted in the following quite clearly defined trends in the finishing industry:

(1) A great boom in those industries which manufacture articles which are required abroad, and a significant reduction in industries whose goods are not wanted overseas, because even if wanted in the home country the raw materials required for their manufacture cannot be spared and must primarily be used for the export industries.

(2) There has, therefore, been a very considerable emphasis on manufacturing and production costs, which it is realized must be reduced to the minimum if the goods when manufactured are to withstand foreign competition.

(3) There is a widely held view that British goods must conform to high quality standards, for two reasons: first, the appearance of the goods must be attractive to potential buyers, and hence the finish plays an important part in the production of the goods; secondly, these finishes must also be fully protective, because an important proportion of such goods enter foreign countries whose climatic conditions may be of a highly corroding nature; in any case, goods must obviously readily withstand long ocean voyages.

These last two requirements conflict, in that on the one hand high quality must be aimed at, which obviously tends to increase costs, while at the same time the goods must be produced at such a cost that they are also competitive with the foreign product. There is thus a constant battle between the protagonists of quality as against cost, and with the additional necessity for high output, the problems entailed are at times difficult of solution.

Bright Nickel Plating

As is probably well known, bright nickel development in Great Britain has different quiet markedly from that in the United States, in that there has been an almost universal tendency to avoid the use of organic brightening agents; in consequence, the bright nickel solution based on the cobalt constituent has been widely used over here. The two types of bright nickel solution which have close similarities, namely, the Weisberg process and the Heinrichsen process, have held almost universal sway here for the past decade or more.

Within the last year or so, however, executives in the industry have looked about to avoid the use of cobalt, either in the form of a salt or as an alloy anode constituent, because of the cost

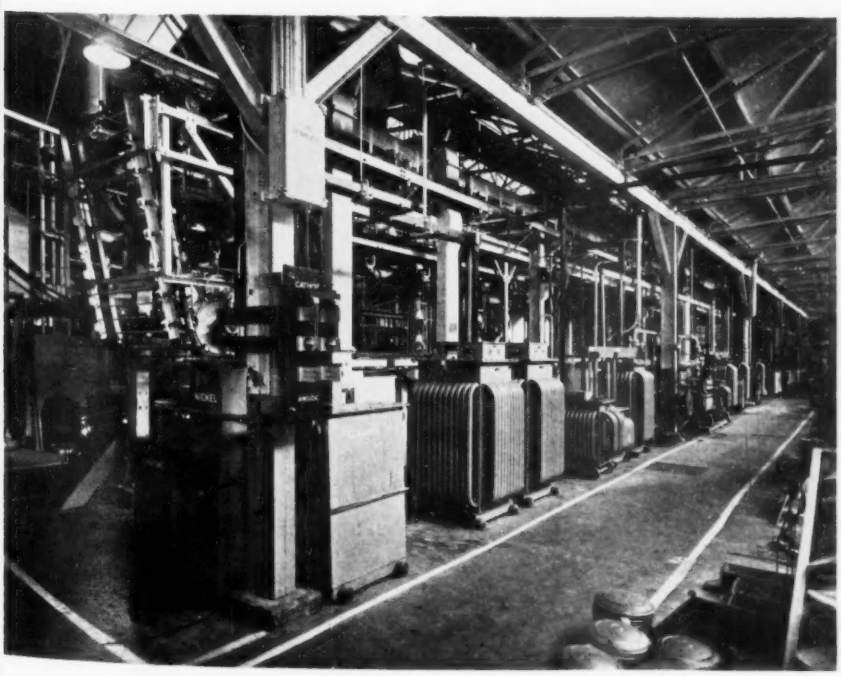
of this metal. Cobalt bright nickel solutions have served the industry well and their idiosyncrasies have been deeply studied and are well known to British technicians. The cobalt solution is a reliable one, and it is with some reluctance that it is being abandoned at all, but the force of economics is gradually driving it out of the industry. In the last twelve months at least two new solutions have made their appearance: one from America and the other a British process, both based on organic additions, and already there is a fair move in the direction of employing such processes. While these organic types of solutions are undoubtedly more economic, they are beset by their own peculiar problems, and possibly because they are not so well known to British operators as the cobalt process, the movement is a slow one. The likelihood, however, is that it will gain impetus, and while the cobalt solution may not go into complete eclipse, because it would appear that this latter solution produces deposits which are not so highly stressed as those which are obtained from the newer solutions, the probability is that the organic solutions have come to stay.

Automatic Plating Plant

It is widely realized here that as far as possible manual methods of production must give way to automatic methods wherever this is feasible. Automatic methods are, of course, more widely used in the United States, where production of similar components or lengthy runs of such components make such plant eminently suitable. Production in Great Britain is on a much reduced scale, but nevertheless, in many industries it is sufficiently large to call for automatic plant, and such plant is being used to a greater extent than ever before. Here again, executives and technicians have spent much time in earnest examination of the plant which is available both in this country and the United States, and this has been done on an entirely impartial basis with a view to securing the best plant which is likely to require the least amount of maintenance and correspondingly reduced costs. Both British and American plant is being used in automatic plating, and it is likely that equipment manufacturers in both countries will have to be "on their toes" to compete for the favor of being employed by British industrialists.

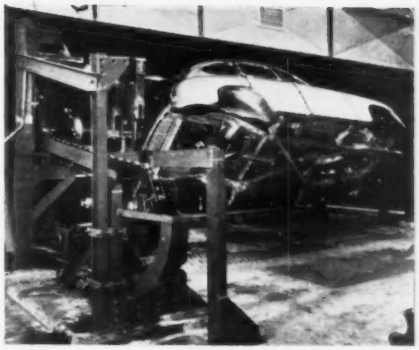
Polishing Equipment

There is no doubt that automatic polishing has not nearly reached such a high pitch of application or perfection as that which is available in the United States. This is due not so much to lack of native talent here to produce such equipment, as the fact that to date the problem has not been so seriously studied in its many phases as has been the case in America. There are many in the metal finishing industry in this country who feel that a more serious approach will have to be made to the design of polishing machines if one of the costliest metal finishing operations — that of manual polishing — is to be reduced.



(Courtesy of Electrochemical Eng. Co. Ltd.)

Fully automatic bright nickel and chrome plating machine of the Duplex carriage type.



(Courtesy Fischer & Ludlow Ltd. Pyrene Co., Ltd.)

Complete car body entering cleaning and phosphating machine.

That the ability to improve mechanical polishing equipment is not absent in these shores is proved by the fact that an entirely novel approach to the problem has been made by one British commercial organization, which has been intensively engaged for some years in developing a new type of polishing machine which may well revolutionize polishing procedure on the smaller class of metal components. A more detailed announcement of this development may be expected in the near future.

Electric Power and Control Equipment

As is well known, this country has led the world in the development of static power units for electrochemical purposes, and in consequence it is probably true to say that the bulk of power units employed in British plants to produce current for electroplating and ancillary processes are no longer motor generators, but rectifiers. These power units are built up in standard units to amperages running into many thousands and have obvious advantages over the motor generator, which they have now largely replaced. They have been found to be economic not only in the cost of power supplied, but also in their practically negligible maintenance, and are extremely popular with British electroplaters. The copper oxide rectifier has very largely given place to the oil-cooled selenium type, which has proved to be more efficient and less liable to breakdown or corrosion of the component selenium coated plates.

The author recalls during his visit to the United States in 1947 being very surprised to find that, amid all the considerable evidence of major development in practically every phase of

(Continued on page 112)

Finland

By Erik Nordgren*

(Courtesy Finnish National Travel Office)

Helsingfors Station. Built of rose-gray granite, it is considered one of the most beautiful granite buildings in the world.

IN attempting to describe the status of metal finishing in Finland, it may be wise first to tell something about the industrial situation with which it is closely connected. Finland was at war from 1939 to 1944 practically continuously, and lost it. During the war the industry was fully occupied for war production, and after the war there is an enormous war reparation to be paid. It has to be paid in materials, and especially products of the metal industry. Before the war the metal industry in Finland was on a rather small scale, and most of such products were bought from abroad. Foreign currencies have been very restricted, as has also all import. At the same time the industry has had to be enlarged very much, building it up from practically nothing. Metal finishing is, of course, directly coupled to the metal industry, and so has followed the same evolution.

The first to bring metal finishing to the country were probably the jewelers, perhaps a century ago. They followed their old inherited traditions, kept as a valuable secret of the profession, and many of the methods were used without understanding them. If something went wrong it was the fault of the operator, who did not know all the secrets thoroughly. Even in 1939, the electroplaters were a very exclusive class of specialists, and most of them were practically self-made.

Plating Developments

Developments in the field, especially in Germany, began then slowly to penetrate into Finland. The Germans studied the problems of electroplating a little more carefully, and decided to make money on it. It was particularly firms like *Langbein-Pfanhauser* and *Schering-Kahlbaum* who were acting on the Finnish market. They and their Finnish agents sold the ready-mixed chemicals and apparatus, and short instructions of use were translated into Finnish. But if anything went wrong with the baths, it was necessary to take a sample and send it to the factory, which then furnished the corrigating chemicals required.

Aside from this, some people also about at the beginning of this century knew the acid copper baths and the dull nickel baths. But methods of test were very elementary, and it could often be seen that the electroplater tasted the acidity of a bath with his tongue. In the twenties the zinc and cadmium baths also found use, and were commonly adopted, particularly by the beginning radio industry. Aluminum sheet was first used in this line for chassis, etc., but it was soon found that common pickled steel sheet, electroplated, was far more sturdy and at the same time cheaper. Before the war cadmium was most widely used for this purpose; afterwar trends have been more for zinc, as cadmium has become extremely scarce, and zinc is far cheaper. Also, the use of bright zinc baths was adopted, and after-treatment methods to save the brightness learned. Nowadays, cyanide baths are almost exclusively used. They are much faster-acting, and much higher values of current densities can be allowed, with an increased turnout as result. Also chrome baths are in use; hard chrome for special purposes, but the common chrome baths mostly for decorative and marine applications.

"Still" baths of sizes up to thousands of gallons are the type almost exclusively used; remarkable enough, only very few barrel plating machines can be seen, as also ringbaths and other rationalized apparatus. The interest in these is, however, rapidly increasing, but domestic industry is too busy to produce them, while import restrictions prohibit the purchase of foreign machinery.

Commonly, the large concerns in the metal industry line have very well equipped departments, using modern baths, either compounded by themselves, or using good commercial ready-mixed chemicals. They are also commonly equipped to analyse their baths chemically, controlling with pH-meters and making plating tests on a laboratory scale and controlling the result with porosity and thickness meters. On the other hand there are old, well established firms specialized in the field, but they seldom have the resources of the bigger industries, more reverting to old, experienced methods, or new methods on a cut-and-try basis. But there is now a younger generation of electroplaters, who have learned their profession and are interested enough to study and develop.

For degreasing, the old methods with lye, gasoline, etc. are still used in the smaller shops, while the larger use trichlorethylene machines, and even

*O. Y. Nortek, A.B., Helsingfors, Finland.

the newest emulsion degreasing methods.

Power Supply

The main sources of electric current are still the rotating motor-generators, rather large units commonly being used, with busbars running along the shop, and separate current-regulating resistors mounted in the vincinity of the baths. The newer trends are, however, towards dry rectifiers using copper oxide or selenium cells. Rather large units are already in use, delivering tens of thousands of amperes, and some of them immersed in oil for insulation and cooling. These allow for a great freedom in plant design, and as the best layout is perhaps considered a separate rectifier for each bath, the rectifiers are equipped with constant voltage regulators. In this connection may be mentioned that a few years ago the electricity was rationed, thus limiting production in the electroplating line. This was due to some extremely dry years with shortness of hydroelectric power, while scarcity of foreign currencies prohibited the import of enough coal. The situation is, however, better now.

Drying of electroplated goods is mostly effected in heated sawdust, after washing in hot water. This is a rather troublesome method, as some sawdust always is sticking to the articles, and must be brushed off. In some cases this drying has been combined with a light polishing in a rotating barrel. The method considered most modern for drying is the centrifuge, through which there is a stream of hot air.

Still plating department at the Bjorkboda Bruk A. B. plant.

Polishing

Polishing is almost always done manually on ordinary polishing machines, using felt bobs with glued-on abrasives or tripoli, and with canvas bobs. For articles mass plated in barrels, barrel polishing using sawdust, sand, pieces of leather, etc., and some lubricant is sometimes used. Band polishing machines are hardly known, and even for larger-sized mass produced articles there is still no automatic polishing machine existing in the country.

Miscellaneous Finishes

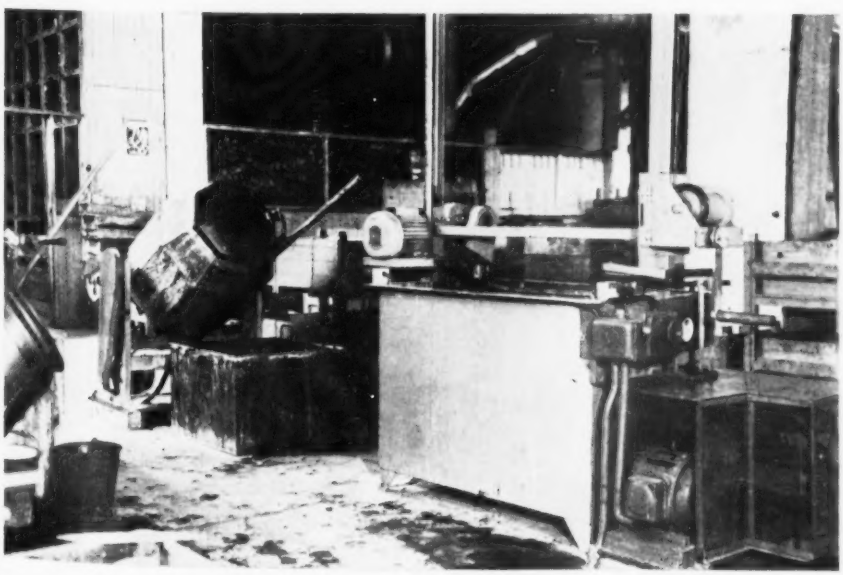
The rumors of electrolytic polishing have reached the country, but tests have been made only on an experimental scale. The same applies to reverse current plating, which has awakened particular interest for silver baths, but no successful setup is in operation. All these methods are of interest, as wages have become a more and more determining factor in afterwar Finland.

Chemical coloring and oxidation of metals is mostly carried out according to old, inherited methods, with very varying results. Mixtures containing shoe-polish, etc. are still used, and while people admit it is irrational, they have nothing better to suggest. Methods like anodic oxidation of aluminum are hardly used in this country.

Metal spraying is used to quite a large extent by some companies. Particularly it has been adopted as a protection against corrosion for different parts for the cross-country high voltage lines, but also for several other purposes. As an example, one company has been successful in metal spraying small warping boats used for moving timber floating on the rivers. These boats have, quite naturally, to stand a lot of abuse, frequently colliding with the timbers and other rough treatment. The old wooden boats did not stand it for any long time, so the new design can be considered a big improvement.

Hot-dip methods for obtaining protective coatings of zinc or tin is much used in various industries, as for instance steel parts for the shipping trade, etc., and is also almost exclusively used for coppersmith work.

(*Continued on page 99*)



Barrel plating section of the Bjorkboda Bruk A. B. plant.

France

Paul E. Bourgeois*

Joseph P. Loiseau

THE techniques of electroplating in France are greatly influenced by American techniques. American periodicals such as "Metal Finishing" are reference sources of the first order for French engineers. But regardless of how we admire the full-automatic electroplating conveyors of the U.S.A., they are not much more than an inspiration to us in France. The scale of our electroplating industry cannot be compared with the American industry, and it is necessary for us to devise equipment more adapted to production conditions in our country.

Nickel Plating

For the protection of steel and cast iron pieces, direct nickel plating without an undercoat of copper is most frequently used. The objects coming from the polishing department first undergo a degreasing with organic solvents (tri- or perchloroethylene). The steps of the treatment are then as follows:

1. Cathodic degreasing in a solution of caustic soda, sodium cyanide, and sodium orthosilicate. Room temperature at a current density of 6-8 A/dm² for about 1 minute.

2. Rinsing in cold running water stirred with compressed air.

3. Anodic etching in a sulfuric acid solution of which the density may vary from 25-53° Baumé. Room temperature at a current density of 10-15 A/dm² for 2-5 seconds.

4 & 5. Rinsing with cold running water stirred with compressed air.

6. Nickel plating: Three types of bath are used.

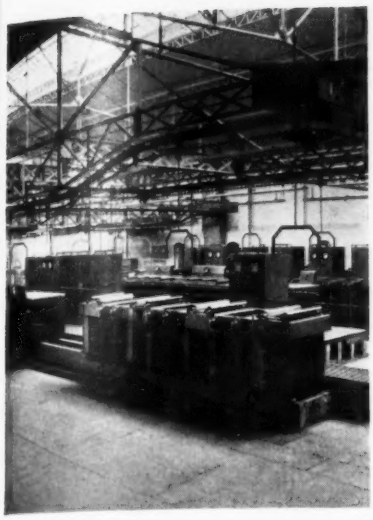
a. *Watts-type bath of high concentration.*
   Temperature 40-50° C.
   Current density of 8-10 A/dm² (75-93 a.s.f.)
   Stirring with compressed air
   Continuous filtration
   Deposit of 1.6-2 microns per minute (.00006-.00008" min.).

b. *Hinrichson type bath (nickel-cobalt).*
   Temperature 40-50° C.
   Current Density of 4-5 A/dm² (38-46 a.s.f.)
   Stirring with compressed air
   Continuous filtration
   Deposit of 0.8 — 1 micron per minute (.00003-.00004" min.)

c. *Watts-type bath with brightening agents.*
   Temperature 50-60° C.
   Current density of 5-8 A/dm² (45-75 a.s.f.)
   Continuous filtration - selective electrolysis
   Deposit 1-1.6 micron per minute (.00004-.00006" min.).

7. Rinsing in cold running water stirred with compressed air.

*Pernix Grauer & Weil, Paris, France.



Installation for plating typewriter parts at the plant of Japy Freres, Arcueil.

3. Rinsing in hot water at 80° C.

In the case of cast iron the anodic etching is followed, after rinsing, by an electrolytic degraphiting operation. In the case of cuprous metals, anodic etching in the sulfuric acid solution is replaced by *Hothersall* anodic etching.

The use of nickel baths of type (b) and (c) frequently allows the deposition of chromium without polishing of the nickel deposit. Manufacturers of a high quality merchandise protect the pieces of steel with a deposit about 20-30 microns (.0008-.0012") in thickness.

The adhesion of the film of nickel to the support is remarkable, thanks to the anodic etching, the object of which is to suppress the Beilby film and to cause the crystalline system of the surface to re-appear. The "electrolytic" metal is therefore deposited in continuation of the crystals of the base, and its adhesion is perfect. The treated pieces may be subject to the following tests:

1—violent hammering, and bending through 180°.

2—heating to 800° C. and bending through 180°.

3—heating to 800° C., quenching in water, bending through 180°.

In each of these three cases exfoliation of the film of nickel cannot be noticed.

Copper Plating

Copper plating is most generally employed for protection against cementation (carburizing). Formerly, the most generally used technique used on steel consisted of:

1. A first deposit of copper in an alkaline electrolyte composed of copper cyanide, sodium cyanide and Rochelle salt. Room temperature, and current density of 0.3 A/dm². Duration 1 hour — thickness of the deposit about 5 microns (.0002").

2. A second deposit of copper in an acid electrolyte composed of copper sulfate and sulfuric acid. Room tem- A/dm². Duration 2 hours and a deposit about 20 microns (.0008") thick.

The system used for the last ten or more years consists of a single deposit of about 20 microns (.0008") in an alkaline electrolyte heated to 40° C., obtained in thirty minutes at a current density of 3 A/dm². This deposit presents a homogeneous and compact structure which is of superior quality to that previously obtained.

Hard Chromium

The extension of hard chromium applications into industry has caused the creation of special shops within factories in order to assure:

a. the maintenance of testing tools.

b. the protection of manufactured pieces against wear.

The preparation of surfaces before chrome plating necessitates meticulous care. The conditions for success are:

a. the complete elimination of all traces of grease or oxide.

b. the preparation of an active crystalline surface to assure the adhesion of the deposited chromium.

c. the distribution of the current as uniformly as possible.

The elimination of grease is generally effected by means of chlorinated solvents. The preparation of an active surface necessitates the use of anodic attack at a high current density (15 A/dm²) in a sulfo-chromic solution.

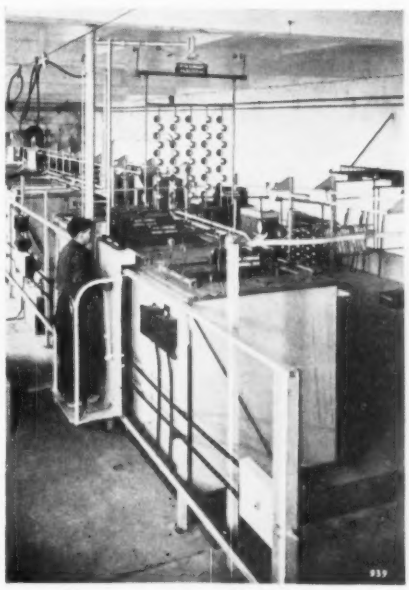
To avoid the entrainment of iron liberated on the surface it is necessary to proceed with an energetic rinsing in a current of water first, then in hot water in order that the temperature of the piece will be essentially that of the chromium plating bath.

The electrolyte for hard chromium plating consists of:

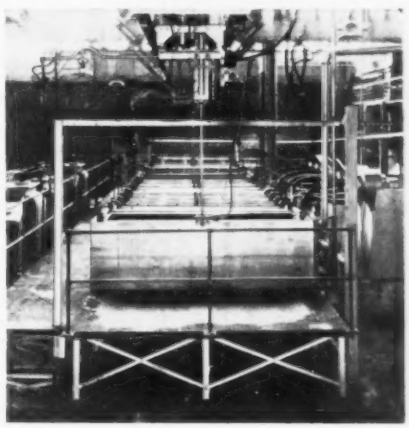
Chromic anhydride (CrO_3) — 300 g. per liter

Sulfate ions (SO_4) — 3 g. per liter

It is used at a temperature of 50° C. in a tank lined with polyvinyl chloride, heated in a water bath and equipped with a thermostatic regulator. The pieces are fixed on special mountings assuring good contact, a good distribution of the current lines (auxiliary anodes, polarizing screens or not), evacuation of the gaseous products of electrolysis, ease of rinsing, etc.



Novel plating installation at Morellet-Guerineau. See text for description.



High speed nickel plating machine at the plant of Jantes-Rigida, Noyon.

Automatic Plating Equipment

French production in comparison with that in the U. S. A. is obviously very small. Even in the largest factories the use of completely automatic machines is not evident. The full automatic machine is conceived for a cycle of treatment and a determined thickness of deposit in continuous production. In the French manufacturing processes it is frequently necessary to obtain deposits of varying thickness in the same installation, according to whether the article being treated is of high quality or just ordinary grade. It is often necessary to be able to modify the treatment in respect to the time of electrolytic deposition. The problem has been resolved in several manners.

In the special plating installation

(*Continued on page* 115)

(Courtesy American Overseas Airlines)

Heidelberg University, world-famous cultural institution.

Germany

By Dr. Richard Springer*

WHEN I had the honor 13 years ago of speaking before the First International Conference on Electrodeposition in London on German electroplating practice, I spoke as the representative of a united Germany. Today Germany is divided; its economy has been violently disrupted; it has various standards and even various postage stamps. Only the postage fees are still recognized by the various divisions of present-day Germany. In spite of this division I shall try to report on German electroplating techniques as a whole.

During the first post-war year in Germany the electroplating industry was entirely unimportant. One part of the equipment was destroyed through the activities of the war, while another part was lost by dismantling. The remainder lay still for the most part, because lethargy, loss of hope, and despair hung like leaden weights on the people, and the development of any initiative was thwarted. Today the electroplating industry is thriving because the need for metal products is great due to the cutting off of production during the war and post-war years. The largest German contractor in the field of electroplating (*VEM Spezialwerk fur Galvanotechnik in Leipzig*) was able to triple its operations during the year 1949. This should even develop further, because not only the domestic need but the needs of all of eastern Europe are also great. This field may be intensified if eastern and western Germany are again united into one centralized and unified economy. The wider development of all German industry and German electroplating depends upon this.

Degreasing

We use chiefly trichloroethylene (perchloroethylene for light metals) for the customary organic degreasing operation. Of the boiling degreasing agents, preparations based upon trisodium phosphate or sodium silicate control the market. In this field one also hears of the interesting degreaser based upon sodium hexametaphosphate which shows high capacity and has seen wide use. Its advantage lies in the fact that it forms easily soluble complex salts with both alkali metals and heavy metals. In addition this new degreasing agent has the power to liberate metallic soaps in solution and thereby regenerate soap by re-combining with the sodium compound.

Pickling and Etching

In the field of pickling the second volume of the "*Handbook of Metal Pickling*" by *O. Vogel*, appeared in 1943. The aged author, with the help of his daughter, laboriously reconstructed this part of the manuscript from the bombed-out ruins of his house. This handbook presents exhaustive information on all practical questions, and also the theoretical foundation is fully treated.

For the etching of stamped cylinders in the graphic industry, acidification is done with hydrochloric acid, and a nearly saturated solution of a mixture of potassium and ammonium chloride has also been proven to be good.

Nickel Plating

In the period before the currency reform and also at a later time a large number of the nickel baths found in use in Germany had a common error: they were contaminated with zinc because of impure anodes or insufficiently purified nickel sulfate. Pure anodes or salts were very hard to obtain at the time. In most cases the treatment of these baths with 1-2 kg of caustic soda or soda ash per 100 liters succeeded in returning their utility. This method of purification through the precipitation of nickel hydroxide or nickel carbonate, was proven to be good with zinc or other disturbing foreign metals, in many hundreds of cases. Only copper is not effectively removed by this procedure.

Chrome Plating

In the first post-war years it was not possible to do decorative chrome plating to the desired extent, especially in Eastern Germany, since the chromic acid was not available. Decorative chromium plating first began to assume greater importance after the currency reform. For chrome plated brass armature parts an intermediate layer of nickel .0002-.0004" has been shown to be sufficiently thick.

Zinc Plating

In zinc plating today in Germany, alkaline baths are used for the greater part, to which are added sulfur compounds and organic addition agents. The formation of a zinc deposit of 0.2-

*V E M Spezialwerk f. Galvanotechnik, Leipzig, Germany.

0.3 mm (.003-.012") thickness from an acid bath has little practical value.

Silver Plating

Many important improvements have been made in the field of decorative silver plating. The Weiner type decorative silver bath, which is extensively used in the industry, depends upon the mixture of selenium compounds and partially decomposed condensation products of albumin and fatty acids in the bath. The procedure requires moving the work in the solution and allows a cathodic current density of 2-3 A/dm^2 (19-28 a.s.f.). The deposit is very bright.

Another bright finish which depends upon a mixture of turkey red oil, potassium xanthate and nickel cyanide, has not met with equal success in practice.

Gold Plating

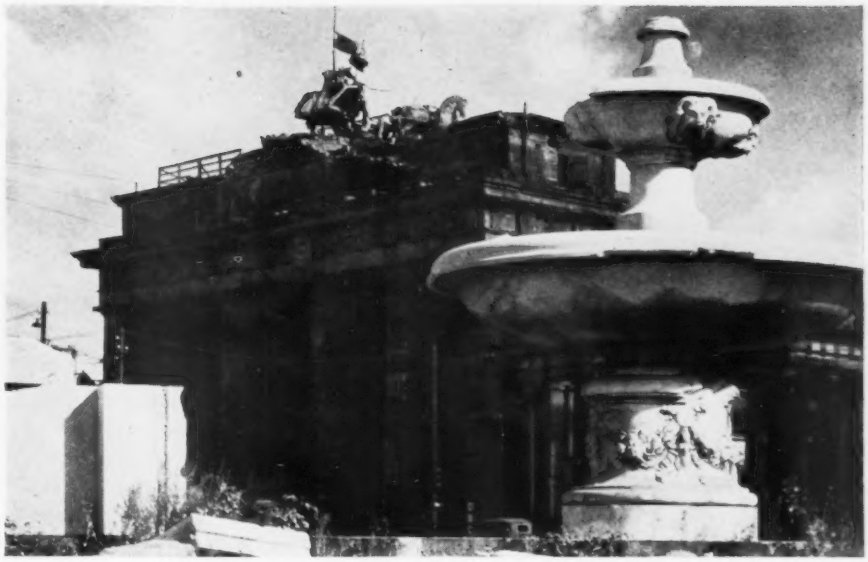
The Avidor process was further developed for the preparation of hard gold plate, which requires the deposition of nickel with pulsating direct current of various voltages. In this case the high voltage impulse acts to precipitate the base metal. Layers of 4 to 6 microns (.00016-.0002") thickness, which may be formed in one hour by this process, are so durable that watch chains and bracelets have been known to be used for years without perceptible wear of the gold layer being noticed. Colored gold plate can be obtained through special careful handling of the bath.

Oxidation and Surface Treatment of Aluminum Alloys

In this sphere the electrolytic oxidation of aluminum in sulfuric acid and sulfate baths has been the subject of numerous published patents. Nevertheless, today in Germany the work is done preponderantly in sulfuric acid baths according to the Eloxal-Arbeitgemeinschaft patents.

Protective Coatings on Magnesium

Much energy was applied in Germany to the useful application of electrolytic oxidation to magnesium. Unfortunately the results were only of limited value. The specifications for all of these coatings can be met through a supplementary impregnation with lacquer. Results are only certain on the electrolytic oxidation of magnesium castings and die castings. In addition, the question can be asked whether or not the costly anodic treatment is so advantageous over the simple dipping treatment in bichromate solution as to justify the greater expense.



(Courtesy American Overseas Airlines)

The Brandenburg Gate as seen through the broken statutes of the Tiergarten.

Oxidation of Iron and Steel

In spite of numerous attempts, it has not been possible to develop a practical process for the electrolytic oxidation of iron and steel which produces a layer superior to that produced by chemical oxidation. Chemical oxidation baths which contain oxidizing agents and other additives besides caustic soda are in wide use.

Phosphatizing

Today, phosphatizing is preponderantly done in a hot phosphoric acid solution of zinc phosphate plus an oxidizing agent.

The production of phosphate layers as metal coatings is playing an ever increasing role in German industry. This is done principally for two quite different reasons:

1. For corrosion resistance of pieces of iron, steel, and zinc.

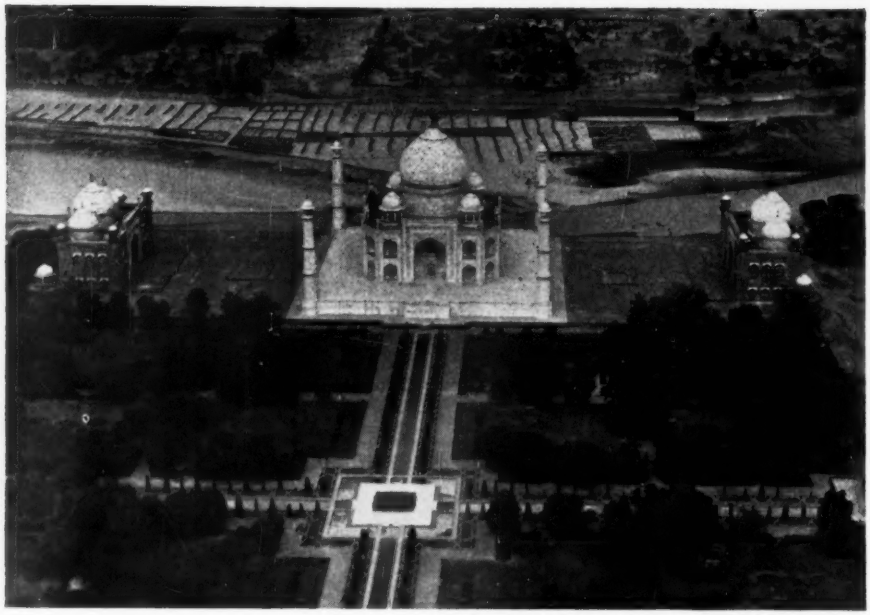
2. To facilitate the drawing operations in cold forming.

The development of a practical solution for cold phosphatizing is easily the most important improvement produced in Germany during the war in this field. In order to produce a phosphate layer at room temperature it is necessary that the following conditions be filled: the pH of the bath must correspond approximately to the equilibrium pH of primary zinc phosphate and free phosphoric acid; and the added oxidizing agent must be suffici-

(Continued on page 116)

The German library at Leipzig, which contains over 2 million volumes.

India



(Courtesy British Overseas Airways Corporation)

By Dr. T. Banerjee*
Ph.D. (Lond.), D.Sc. (Dac), F.R.I.C.

ALTHOUGH electroplating is new to India, the art of metal finishing has long been known to Indians. The gilded decorative wares produced in olden days present the same appearance as though finished only recently. There is enough evidence to prove that in ancient days India was well advanced in all the sciences, including the science of metals, at a time when the West was comparatively ignorant. It might be of interest to note that the iron pillars cast during the reign of Asoka in the third century B.C. have not undergone any rusting though they have been exposed to weathering since then. The plating industry, however, is of comparatively recent origin and there were hardly more than a dozen plating shops in the country in the late nineteenth and early twentieth century. At present, there are more firms in each town than there were throughout the entire country in the early days. Indian manufacturing industry, though itself in its infancy, has only recently realized that the finishing stage of the manufactured article is of major importance. It is believed that the rapid industrialization of the country with the advent of its freedom will give a still further impetus to this industry.

In India, although practically no separate industry exists as such, electrodeposition operations are extensively carried out from the largest Government and industrial workshops down to the numerous re-plating shops throughout the country. It will be evident from this that the actual operations vary from the most up-to-date methods carried on in modern plants to haphazard methods of small re-platers.

The electro-plating activities in this country may broadly be classified under the following heads:

1. Industrial factories manufacturing their own specialized products which are equipped with their own plating and finishing facilities.
2. Government workshops, railways and ordnance factories which have recourse to electroplating to meet their own requirements.
3. Job working and re-plating units.
4. Thread gilding (Jari) industry.
5. Metal ware and cutlery manufacturers doing mostly metal-polishing and partly electroplating.

Details of the above classification are given below:

Industrial Workshops

Under this may be classified cycle, automobile, and machinery manufacture. These industries in India are only in their infancy; for example, India has only one plant manufacturing cycles, though she is the biggest purchaser of cycles from Britain. Automobile manufacture is also in its infancy at present; however, a few big organizations like Ford, Nuffield and Austin in collaboration with Indian industrialists have set up their assembly plants with the ultimate object of manufacturing cars in India. Textile machinery, sewing machines and other miscellaneous engineering goods are also being manufactured in India. The bulk of the production is not enough to take care of even a fraction of the country's requirements, and there is good scope for expansion in the near future.

Most of these workshops are well equipped with their plating plants. The work done in these units is essentially the same as in any Western country and similar baths are used.

As with private enterprise, government works are also equipped with their own units.

General Plating Shops

These are generally spread all over the country and their activities are mostly confined to copper and nickel plating and copper oxidizing, though a few plants are equipped with silver and chromium plating also.

The conditions under which most of these works are conducted are far below the requisite standard.

Despite all the shortcomings it must be said that the type of work done by the average shop is encouraging. This shows that the workman himself is not lacking in skill, and that given sufficient equipment, materials and the requisite scientific training, a high standard of work could be achieved.

Thread Gilding Industry

In India the plating and finishing technique has found its best application in the thread gilding industry. The plated thread is used for making brocades, borders, etc. for ladies garments. This thread is known as "Jari." Originally, pure gold or silver wire drawn to very fine diameter, known as "sucha jari" was used but in view of

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its high cost it is being gradually replaced by imitation jari.

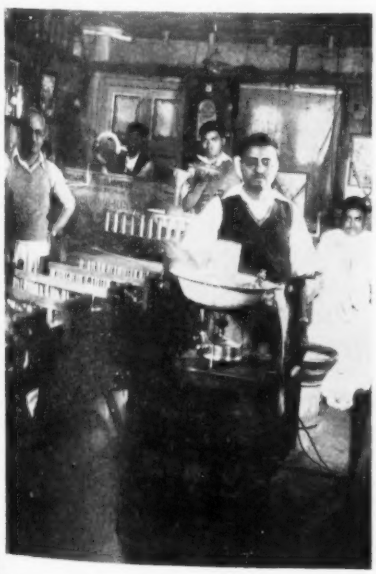
The production of imitation "Jari" consists in silver plating on finely-drawn copper wire. The plating is continued for 15 minutes to 2 hours depending on the thickness of silver required to be deposited. The total weight suspended in a bath at times varies from 21 to 51 lbs. To produce gold color, the silver plated jari is plated with copper or preferentially with brass. Some firms give a protecting flash of gold also. These wires are then used for production of brocades, etc.

The "Jari" plating in India is essentially a huge cottage industry. It employs about 7,000 persons in plating only and an annual business of millions of rupees is transacted. Each firm has its own plating method developed from methods given in various text books and experience. The industry is mostly centered at Surat, in Bombay Presidency. The accompanying photographs show the plant of *Messrs. Bhagwan Das Atmaram*, one of the biggest producers.

The photographs clearly demonstrate that the industry has not been placed on a truly scientific basis. Attempts are now being made to group the "Jari" firms and put this business on a scientific basis.

Metal Ware Manufacture

This trade has been and is flourishing mainly in the U.P. area in manufacture of different varieties of domestic and art metal work. The main centers of this trade are Aligarh, Moradabad, Delhi, Mirzapore and Banaras. The performing of the correct type of



Scene in a Jari plating plant (Bhagwanda Atmaram Mehta Jariwalla, Surat).

The new National Metallurgical Laboratory at Delhi.

polishing is also a pre-requisite of efficient electroplating, and requires effective ingredients in polishing materials with graded abrasive action in various stages of the process. A slight deterioration in the quality of composition of the polishing material may seriously affect the whole industry, which has not only a countrywide market bid also a good foreign trade with Africa, the Middle East and S.E. Asia.

The bulk of the plating and finishing industry in India, except that classified under the first category, is on a cottage industry scale, and the work is conducted as an empirical art, using processes that are considered secret and lack scientific basis.

The following deficiencies are found in many plating shops:

1. Experts having any academic training in the line. The work carried out is not on scientific lines except as regards the instructions available from the manufacturers of equipment and materials.
2. Absolute cleanliness, which is an essential pre-requisite of electroplating. The lack of proper ventilation, sanitation, correct layout and space are the main reasons for unclean and unhealthy conditions.
3. Proper equipment: these shops mostly carry out work with insufficient equipment with which they can just manage.

Future Progress

The author is making serious endeavors to place the entire plating industry in India on a scientific basis. It is proposed to form an *Indian Electrodepositors' Technical Society* on the same lines as in U.K. This will bring the plating industry together to discuss the common problems and solve difficulties.

Sir S. S. Bhatnagar, Director, Scientific and Industrial Research (India) is responsible for the establishment of various research laboratories in India. These laboratories, besides taking up problems of a fundamental nature, will give top priority to the needs of the Indian industry. The National Metallurgical Laboratory, which is one of the eleven National Laboratories under the Council of Scientific & Industrial Research (India) has already begun to have a fully equipped plating section. The author (*T. Banerjee*) is also looking after the planning of this Section. It is proposed to have almost all the common plating baths on a pilot plant scale, where research both fundamental and applied will be carried out. Alloy plating will play a prominent part in our programme.

It is hoped that the activities of the National Metallurgical Laboratory will go a long way in solving the immediate needs of the industry. The following will be the main line of attack:

(a) Chemicals and other Raw Materials

Indian plating industry has to depend mostly on raw materials which are imported from foreign countries under various trade names. The present economic situation with limited foreign exchange, however, does not permit a liberal import of all these chemicals, and at times the work of the plating industry is seriously handicapped due to the non-availability of the essential chemicals. The National Metallurgical Laboratory has already started preliminary investigations for the production of the various electroplating chemicals. Indian production of heavy chemicals like hydrochloric, sulphuric and nitric acids, caustic soda, etc., is sufficient to meet the country's requirement.

As regards the production of other plating equipment like generating plant,

(*Continued on page* 116)

(Courtesy of Pan American World Airways)

Ruins of the ancient Colosseum at Rome.

Italy

By Prof. Roberto Piontelli*

THE electroplating industry of Italy has only recently begun to attain a satisfactory state of development, as a direct result of the rise of a manufacturing industry wherein metal finishing plays an important role.

The reasons for the retarded development are, in the author's opinion, as follows:

1. Although there was an abundance of original ideas, there seemed to be no persistent efforts to improve the details of the suggested processes to the point where they would be commercially successful. Early Italian investigators like *Brugnatelli* (the first electroplater of the world), *Marianini*, *Nobili*, *Zantedeschi*, *Sandonnini*, *Selmi*, and others were very clever and distinguished scientists, but they did not apply their efforts to the practical utilization of their discoveries in the art of metal electrodeposition.
2. Organization of most operations on a personel basis, together with a lack of investing capital for automatic machinery and equipment, were not conducive to progress. While hand operations may have certain advantages where artistic ability is needed, the reduction of finishing costs and the production of uniform, high quality results depends on the use wherever possible of semi- or full-automatic equipment and processes.
3. There is very little time devoted in the technical schools to the teaching of electrochemistry and metal finishing. Also, there was no organization through which an exchange of ideas and discussion of common problems could be made. This is in contrast to the conditions which prevailed in the United States and England.
4. The attention of the platers was for too long concentrated on the composition of the plating baths only, with very little attention being given to the other related operations of equal importance in preparation for plating. Only in rather recent times have the platers realized that excellent results could be attained with the classic baths, and that nothing could substitute for perfect preparation of the metals for plating.
5. Only recently have the methods for controlling the various processes and products been widely known, and even more recent are the attempts to standardize specifications.

If the preceding comments seem rather pessimistic, one must realize that the actual situation is rapidly improving. In recent visits to industrial plants a great improvement in methods and equipment have been noted.

Among the outstanding plants in Italy are those of the *S. A. Fiat*, in Turin. This firm is the largest automobile producer in Europe. This plant, now in the state of extensive reorganization, is characterized by the volume of their production, the variety of processes used, and the high quality of their metal finishes. In most respects they represent the best plating standards in the country, and therefore will be described in some detail.

After the usual polishing steps (rough grind, several emery wheel polishes, and brushing or buffing) the parts are degreased. Trichlorethylene vapor degreasing is quite widely used. Electrocleaning, sometimes of the electro-coppering type, anodic etching, and pickling with low-cost inhibitors are also common operations.

Current is supplied mostly from motor generators (with field regulation), but the demand for rectifiers is rapidly increasing. Tanks are most commonly lined-wood or steel construction. The use of plastic lining is frequent, and plastic rack coatings are also popular. Most plating tanks are of the still type, although the semi-automatic type is fairly common and some full automatic units are in project. Plating barrels are mostly of the inclined, open end type, except those used for chrome plating.

Continuous filtration is largely practiced, while activated carbon treatment has not yet attained the proper development, nor is the use of purified water very common.

Alkaline copper plating is done mostly from Rochelle type baths, while acid copper baths, with brighteners, are also used. The acid baths are used to electroform copper rolls.

Nickel plating is mostly from the Watts-type bath, but many plants now have bright nickels of both the nickel-cobalt and organic sulfonate types. Heavy nickel plating is well advanced, but hard chrome is now largely pre-

(*Continued on page* 120)

*Director of the Electrochemistry Lab. and Prof. of Chemical Physics and Metallurgy, Polytechnic Institute of Milan, Italy.

Japan

By Sakae Tajima, D.Sc.
Tokyo Metropolitan Univ., Tokyo, Japan

IT is well known that the Japanese had, from ancient times, distinguished techniques for art and crafts including metal-coloring, lacquering (Japanning), and colored alloys such as the so-called Japanese Bronze (Shaku-do, Shibuiti, etc.). Some of these techniques were introduced from China, India and Korea, but the ancient Japanese had, it seems, the ability of applying them to their own art.

The technique of plating was introduced from Korea at the same time and as a direct result of the introduction of Buddhism (550 A.D.). Buddhism was rapidly popularized in Japan by the support of the Emperors (Mikados) at that time. Temples were constructed one after another, followed by casting of statues of Buddha; these statues were gold-plated, as a rule. Among these, the Buddha of the Todai-ji Temple at Nara is the most famous and biggest in the world. The technique of plating at that time was the amalgamation method (Cu-Au alloy is first rubbed in with mercury, then gold-foil is pressed on it to form gold-amalgam, and then the mercury is evaporated by heat). Another fine example of gold-plating in Japan is the Tosho-gu Shrine at Nikko (constructed in 1642) which is visited at all times by foreigners who come to our country.

Plating by electric methods was originated for gold by *Nariakira Shimazu*, one of the feudal lords, who introduced the technique from a Hollander in 1854.[1]

Electroplating[2]

The current level of the electroplating industry of Japan is, it is supposed, considerably below that of the United States. There are many reasons for this. Owing to the wars of many years, the researchers in the field were very few, free competition among electroplaters was stopped, the quality of materials such as chemicals, anodes, and polishing materials was bad, the economic status had been confused, and wages were unstable. Bright-plating, for example, is not popularized in Japan as yet. This is not so much due to the technical problems as to the impurity of chemicals and surface-active agents, or to the lack and high cost of cobalt-salt. The greater part of Japanese plating firms are still using the old Watts' type bath for nickel, and acid-sulphate and cyanide type baths for copper. However, the state of affairs in Japan is recovering its normal condition and excellent researches, although very few, have come to be reported.

Chrome Plating

As for chromium-plating, there was an important development last year. That is the plating at room temperature, which was announced by *Yoshio Koshino*[3] and which is rapidly spreading in the Japanese plating field. As far as the author knows, the addition of fluoride ion to the Sargent's* solution may not be new, but the author has never heard that it is successfully applied in practice. Mr. Koshino's conditions are as follows:

Bath A

Chromic Acid	250-300	gm/l
Amm. Fluoride	3-6	"

Bath B

Chromic Acid	300	gm/l
Chromic Sulfate	1.5	"
Amm. Fluoride	6	"

For both the above baths

Voltage	3.5 V.
Temperature	Room

The advantages of this process are (1) the operation can be started at any time, (2) good conductivity and good throwing power of the bath, (3) wider range of bright-deposit, (4) better cathode efficiency, (5) the makeup of the bath is simple. But the deposit is, it is said, rather soft. The process is rapidly taking the place of the hot bath in Japanese plating firms.

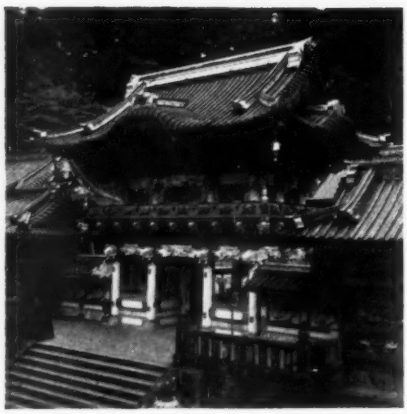
The other important event is the non-poisonous chromic sulfate bath developed by *T. Yoshida*, which consists of Cr_2SO_4-$(NH_4)_2SO_4$-Urea-H_3BO_3-Water operating at 40-70° C. At present the composition seems a little too complex, but the deposit is excellent in quality and the process will soon be popularized in Japan.

Barrel chromium plating is at the stage of experiment by *M. Kishi*, using a CrO_3-fluoboric acid bath. Hard chromium plating on steels was adopted on many products during the War, but at present it is confined to plastic moulds, tools, and textile rollers. Porous chromium plating is not done in Japan.

Industry Statistics

According to the census of January 1949, the total electroplating firms amount to 1625 (job platers 1355, manufacturers 270), employees of which

*In Japan the chromic acid-sulphuric acid chrome bath is called "Sargent's" solution.



Nikko shrine — 350 years old. Columns and accessories are gold plated.

number 25,300 (platers 8149, polishers 9648, business men 2646, others 4866).

The main products handled in the Japanese plating industry are bicycle parts and sewing and textile machine parts, which cover more than half of the total output.

Power

As direct current sources, motor-generators are still the main machines because of their cheaper price, but the selenium rectifier is finding a new market in the plating field. Moreover, there is a unique machine, "Vertoro," manufactured in Japan by the Chuo-Seisakusho, Nagoya, which is a kind of mechanical rectifier.

Anodizing

In Japan, anodic protection of Al and its alloys had been developed early, especially the oxalic bath and sealing treatment, by *Kujirai*, *Ueki*, *Setoh*, and *Miyata*, keeping pace with the developments of the Bengough-Stuart, Alumilite and Eloxal processes. However, no remarkable progress it seems has been made in Japan in the past ten years.

One process which has recently been developed is the finishing of metallic lacquer-ware. In order to prevent the defects of brittleness and warping by moisture of wooden lacquer-ware, aluminum-ware is first sandblasted, anodized in oxalic bath (securing the good adhesion of urushi or other lacquers), then sprayed with wooden-powder and finally painted or lacquered. Thus an excellent art-ware is produced preserving the toughness of the metal and the touch of wooden lacquer wave.

In most firms, the oxalic bath is not so much used as the sulphuric bath because of the high cost of the acid, and the sealing treatment is applied only to special articles. The chromic bath is not used in Japan.

Electropolishing[5]

The prosperity of the electropolishing industry in Japan is very much indebted to the fundamental studies of *Dr. P. A. Jacquet* and others. Excited by their outstanding achievements, we have studied its fundamental phenomena and developed industrial applications. As we were isolated from the world since 1941, the process had to be developed, as it were, by ourselves, and the comparison of the data obtained in Japan with those developed overseas is very interesting. Some results are duplicated, but some different data and progress may also be seen. It will be unexpected by many that the phenomena first discovered in France had borne fruit in the isolated Far East as well.

Industrial applications of electropolishing were developed during the war for parts of magnetrons, pivots of electric instruments, fountain pens, contact points, and exhaust turbine blades of airplane engines.

As a post-war finishing method, electropolishing has found wide applications and is being diligently studied in many factories and laboratories. The main articles processed are turbine-blades of steamers and electro generators, table-ware, measures, reflectors (electropolished and anodized), injectors for medical use, needles, and decorative accessories. The baths generally used as phosphoric, sulphuric, alkaline cyanide, or their mixed systems, with or without additions, by applying A.C. or D.C. current. Perchloric baths are not used commercially in Japan except for small articles.

About fifty reports and reviews have been published and more than twenty methods and operation systems are patented and now on file at the Japanese Patent Office.

As for the fundamental studies, *Dr. N. Takahashi's* elaborate investigation of electropolished surfaces of copper and brasses by electron-diffraction[6] and some of the author's electrochemical researches will contribute something to this field of science.

Metal Coloring and Miscellaneous

From ancient times, the Japanese had unique metal-coloring techniques for copper, silver and golden wares. These techniques were, however, mostly based on the individual artisan's experience and not on science. In many cases, these techniques were initiated from father to his son, and from master to his apprentice in secret, and the articles manufactured by them are relatively high in price and not suitable for mass production. Main producing districts are Kyoto, old capital of Japan, Tsubame of Niigata prefecture and Takaoka of Toyama prefecture.

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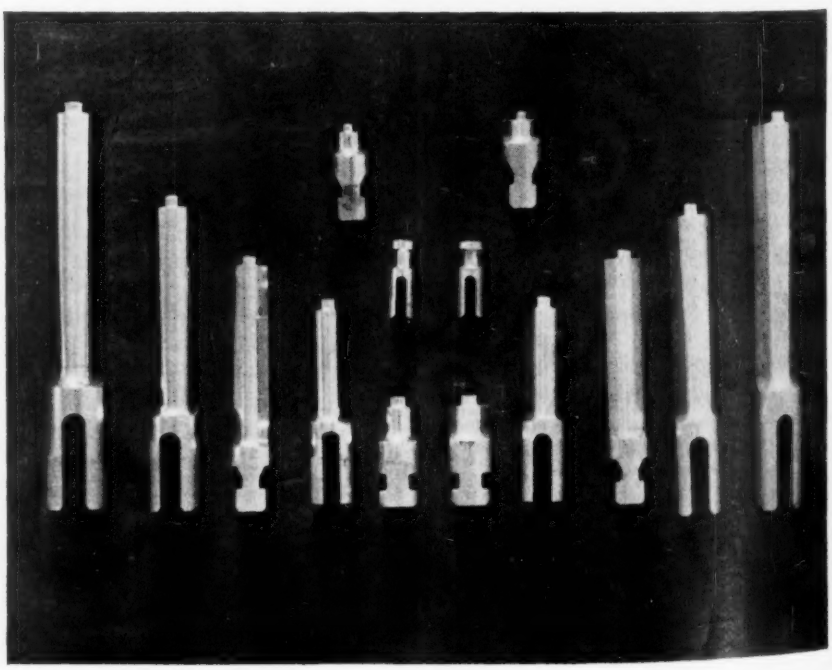


Steamer turbine blades and generator parts electropolishel commercially at the Uraga Dockyard Yokosuka.

Plating Progress in the Low Countries

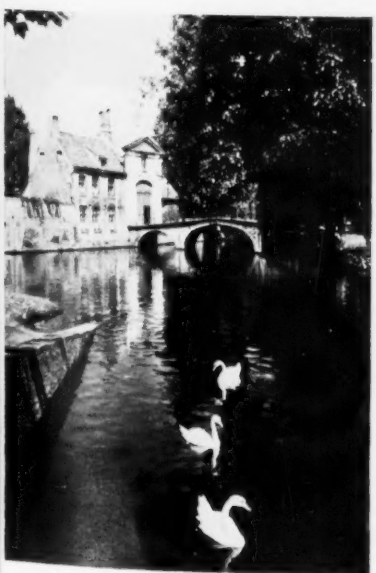
AMONG the smaller European countries where old-fashioned methods of metal finishing were practiced until very recently, may be mentioned Holland, Belgium, Denmark and Norway. The most spectacular progress has undoubtedly occurred in Holland, where something like a renaissance in the science and art of electroplating has taken place within the post-war period alone.

Before the war, it is probably true to say that most of these countries took their inspiration from techniques as practiced in Germany. As is well known, one or two of the best known electroplating supply houses in Germany were responsible for a great proportion of the development work in the metal finishing field, and many of the plants, particularly in the sphere of semi-automatic equipment, special types of barrelling plant, etc. emanated from Germany and spread across the borders not only to the countries mentioned above but also to France, Switzerland, Italy, etc. In the post-war period, there is evidence that, although the German lead has largely been replaced by the inspiration which now comes from the United States and Great Britain, nevertheless, an acceleration in progress in Germany has occurred indicating that German firms may be preparing to re-establish their lead, at any rate among the smaller firms. However, it would seem that this will take a considerable time to come about, if indeed it ever does occur, because the progress made both in Great Britain and America in the last decade is such that advances emanating from either of these countries are given very careful and earnest consideration by executives and technicians in the small European countries.

One has to envisage the state of electroplating technique in these countries prior to the war to realize what is occurring. For example, it was quite common for plating plants to be of the still-tank type, constructed largely of wood carrying a lead lining for acid solutions, while the nickel solutions employed were of complex type, operated at room temperature (which, of course, varied enormously as between summer and winter), at current densities which might be as low as 2 to 3 amps./sq. ft. The solutions were unagitated, all work was wired, and coatings not much more than 5 microns thick of nickel were often applied to commercial work, so that naturally the finishes left much to be desired both from the point of view of porosity and also appearance. Many of the nickel solutions were based on the original Schlotter electrolyte, worked at relatively low current density, and producing semi-bright deposits.

(KLM Royal Dutch Airlines)

Holland



(Courtesy Pan American World Airways)

Canals at Brugges, Belgium.

(KLM Royal Dutch Airlines)

City Hall, Copenhagan, Denmark.

In the post-war years, a number of the manufacturers in Western Europe have made visits both to the United States and Great Britain, when it became immediately apparent that their present methods were deficient; hence, there is a natural tendency to employ the latest practice when new plants are considered, and so a fairly common but interesting spectacle is to come across an old plating shop in which some of the oldest equipment is still being employed, but side by side with it there may be a modern installation with rubber-lined steel tanks, heated solutions, adequate filtration and good arrangements for removing electrolytes from components when they are brought out of the bright nickel solutions.

In particular, important progress has been made in Holland, where probably the developments have been on a larger and more spectacular scale than in any other of the smaller European countries. Automatic equipment has been installed, which includes American built equipment in Europe, and

(*Continued on page* 121)

Mexico

By Miguel Bosch*

THERE are about one hundred plating plants now operating in Mexico. They can be divided into two main groups: the group that take up milling work (job shops) and the plants that follow a definite plan of production in manufacturing their own products. Most all of these manufacturing plants are established in the capital, Mexico City and surroundings.

Raw Materials

Salts and brighteners are imported, as a whole; copper and lead anodes, polishing wheels, pastes, cold-rolled steel and brass are manufactured in Mexico. Sulphuric and hydrochloric acids are locally made. Concerning equipment, we can obtain all kinds of tanks made of lead, ceramic, rubber; asphalt and paint-lined wood tanks are manufactured here, as well as all kinds of electrical conductors and racks. Water generally employed for plating is used without softening; the best is that obtainable in the heart of the City. When water is softened the system generally used is the ion-exchange process. The fuel of lowest cost to generate steam is gas.

Principal Plants

The plating plants that have been influential in the use of new methods of mass production and that use bright solutions for the three main plating processes in Mexico are *Manufacturera General Electric, S.A.*, that manufactures electrical products, *General Motors de Mexico, S.A. de C.V.*, manufacturing automobile accessories; *Muebles Briones, S.A.*, manufacturing metal furniture.

The first company installing a plating plant in Mexico in 1930 for plating automobile parts was *La Consolidada*. For this purpose they installed a copper cyanide bath, a nickel plating bath of the dull Watts type; another for bright chromium plating, barrel cadmium for plating of screws, and a semi-automatic tank for cadmium plating larger parts.

Bright plating solutions were first used by *Muebles Briones S. A.*, manufacturers of all kind of chromium finished furniture. For semi-automatic polishing process they have fibre wheels especially designed and built by their technicians with material obtained in this country, which they use for polishing cast iron surfaces. The plating cycles employed by this firm are as follows:

1—Steel polishing with special fibre wheels.

2—Electro cleaning and acid dip with rinses.

3—Bright nickel plate and rinse.

4—Bright Chromium plate, rinse and drying.

They obtain direct current by means of generators with a total capacity of 6000 amps. They use copper plate very seldom. This plant has a modern research and control laboratory.

General Motors de México has contributed to the development of the plating industry in Mexico by installing a new plating shop with all modern developments. This plant's plating section forms part of the manufacturing department where they give final ornamental and protective finish to the different items manufactured such as grab rails, fixtures, grilles, etc., for busses and refrigerators. The base materials used in manufacture are steel, brass, zinc alloy die-castings, and stainless steel.

The process followed in this plant consists first in the preparation of base metal, polishing it mechanically, followed by a mild electroclean, rinse, acid etch, rinse, and then copper plate in a copper and potassium cyanide bath. The coating is buffed to a mirror finish and the chemical cleaning cycle is repeated, followed by a nickel plate in a semi-bright nickel-cobalt bath, which deposit is more ductile. This coat receives a color buffing, followed by a cathodic cleaning, acid dip, cold rinse, warm rinse, and a bright chrome plate.

The electrical equipment is composed of four 1500 ampere rectifiers. According to an enlargement program of the company, they are installing a modern bright alkaline zinc plate system to protect nuts, bolts, refrigerator parts, etc., against corrosion.

A distinctive note is the good organization and care they take in handling parts, and the good control and quality of raw material and finished products.

Manufacturera General Electric, S.A. is outstanding for the brightness of its chromium plated electrical products

*Chief Chem. Eng., Manufacturera General Electric, S. A. Mexico.

and for the exceptional fine quality of its raw materials.

This plant was designed to produce parts like irons, refrigerator parts, screws, radio parts and other electric home articles. The tank layout is made so as to occupy the least possible space because the solutions are bright and the parts pass through without being buffed, from one tank to another, being only cleaned and etched. The tank list is as follows:

Two 500 gal. tanks: one of them to electroclean nickel, steel and copper, equipped with a reversing switch; the other to electroclean die-castings. The acid dips and rinses are of 300 gal. capacity.

A 500 gal. semi-bright cyanide copper plating tank equipped with a 500 amp. electronic current reversing switch and a cathode rod agitator.

A 500 gal. bright nickel tank with cathode rod agitator.

A 300 gal. ceramic lined chromium plate tank.

A 500 gal. bright zinc tank.

A 500 gal. nickel strip tank (sulphuric acid process).

The plant floor is painted with plastic paint and has a special sewage system with lime blocks for neutralizing acids.

Most of the drawn steel parts that have copper plating are not polished, and the ones that have deep lines are polished with a rough abrasive. Whenever possible, we use the process of first polishing the steel sheet by means of a semi-automatic polisher locally

Polishing shop at General Motors of Mexico.

designed in the plant. The reverse-current copper plate process eliminates much polishing; in other cases it is enough to just polish, leaving the deep lines on, and following the copper plating process with bright nickel and chromium until the part is finished. This process saves time and work, rendering more production at a lower cost.

Another very important section installed for the first time in Mexico by Manufacturera General Electric is the aluminum anodizing process to finish refrigerator accessories and dyed radio ornaments. For the oxidation process sulphuric acid solution is employed. The electric equipment is composed of three copper oxide rectifiers connected in series.

Bright zinc plating is employed to finish radio chasses, screws, refrigerator shelves, etc.

Another important industry using aluminum finishing is *Reynolds Metals Co. of México*, which manufactures aluminum foil, of several colors and of natural silver color, for wrapping candy and cigarettes.

Plating installation for tubular furniture at Muebles Briones, S. A., Mexico.

FINLAND

(*Continued from page 87*)

Vacuum vaporization has been tried on a small scale for producing master matrices for gramophone records. Special surface treating methods, like sherardizing, are little known here.

Vitreous enamelling is done by a few companies in Finland, and only for kitchenware and bathtubs; it is, of course, also used by the jewelers.

Painting is almost always, when used on an industrial scale, done by spraying, with cellulose base lacquers most common. Crackle finish lacquers have been produced within the country for several years, while successful wrinkle finishes have been adopted recently.

Basic Problems

A difficult problem for the expanding metal finishing industry in Finland has also been to get suitable localities. With 300,000 people moving into the country from lost territories, and hardly any new buildings since before the war, it is easy to understand that many shops in this line of work in very limited and unsuitable spaces.

Another difficulty is the lack of suitable literature in the Finnish language. Before the war some handbooks in German were considered as standard, but they were frequently published by some of the firms in the electroplating chemical line in Germany, and emphasized the overcoming of all difficulties by using the ready chemicals mixed by them, so that there was no real understanding of problems. Now there are both American and British textbooks on these subjects for those who understand the English language, as well as good periodicals keeping our knowledge up to date.

When the difficult times for Finland are over, metal finishing methods will be much better than before the war. The whole problem is now treated much more earnestly, and a new generation of electroplaters is fostered on a basis of real understanding, rather than professional secrecy. The requirements put on the quality of the finish have been increased when it has been seen what can be done. Within a few years we will have real competition, and that will do a lot in increasing quality and using cost-cutting, modern methods.

Crown Mines, one of the largest gold-producing mines in the world, descends from 6000 ft. above sea level to half a mile below sea level.

South Africa

By Harold Knocker
Johannesburg, South Africa

THE South African Union is best known abroad for its mineral wealth, especially its fabulous gold mining industry. This country has produced nearly half the world's gold in a period of 50 years. Half of the gold recovered is won by a cyaniding process, and in a manner with which we platers are familiar — immersion plating. After digging it out of the ground in South Africa, then subjecting it to a multitude of chemical operations to produce the final 1000 ounce bricks, we understand that their final end is to be re-buried in the ground again at Fort Knox!

Apart from its gold production, and its industries devoted to the production of shoes, food, blankets and fabricated parts of mining equipment, South Africa did not really come into existence as a manufacturing country until the outbreak of World War II. With the full impact of war, this country experienced a most remarkable Renaissance in the industrial sphere. The structure of industrial South Africa was magically transformed, and it was then that the foundations were laid for the development of a manufacturing industry of considerable importance. South Africa began to mass produce guns, rifles, ammunition, bombs, land mines, grenades, armoured cars, boots, shoes, and the rest of the thousand and one weapons of war that are necessary — when the time comes — to keep an enemy at bay, and to strike back at him. We suddenly awoke to find that we could produce quality goods in amazing quantity: we were turning out products which were highly acceptable because they were badly needed to keep the country going, and as the war progressed, the quality of our products climbed higher and higher with our increasing experience.

The Plating Industry's War Contribution

Before the outbreak of war, the Union's small plating industry was largely confined to the re-plating of such articles as automobile trim and domestic utensils, such as table silverware, cutlery, etc.

When the country got down to war production in earnest in 1940, the government-owned railways had about six fairly large plating shops, which had been established for the reconditioning and protection of the trim associated with rail travel. Soon they were undertaking work of a more serious nature. The South African Air Force had its own "mysterious" plating work to do, such as the anodizing of aluminum, protective cadmium plating, and nickel and chrome. The government-owned Airways also had plating shops for civil aircraft maintenance, which involved the servicing of thousands of parts per engine overhaul, embracing anodizing, copper, tin, lead, nickel, chrome, cadmium, and silver plating.

These Government plating establishments lost no time in gearing up for war production. Snags and heartbreaks bore down heavily on the shoulders of the small band of platers in South Africa, and we had our headaches — not daily, but hourly.

Before going on to deal with some of the factors we were up against during the war, it is fitting at this juncture to mention that, almost without exception, every solution we used was the product of a single United Kingdom firm, and the solution composition was a mystery to each and every plater engaged in the industry. We could have been described as experts in the use of one make of proprietary salts. Very few of us knew the ingredients of even a Watts nickel bath. The demand on the distributors of these proprietary salts became so great in the war years that we eventually found ourselves without supplies. And then fearfully we tried cold nickel anodes in hot nickel baths, and subsequently we added hot nickel salts to cold nickel solutions. Eventually, the eyes of many of us were opened, and we began early in 1940 to show a very great desire to know more about the "secrets" of plating. We used any and every available supply to keep going. Those of us who were in military and government establishments began to get some "highly secret" information, such as formulae for copper, cadmium, nickel, lead, chrome and tin plating solutions, and, of course, we shared the knowledge we so received among others who did not have the "know how." The leading United States plating journal, *Metal Finishing*, helped us a great deal, the Handbook being a most welcome acquisition. We began to feel that we had been very badly done by in being kept in the dark, as far as information on plating was concerned. Soon there

was a strong movement afoot among the younger platers to learn the American methods, and to use American supplies. Up to the time of devaluation, the Union's plating industry was drawing supplies of raw materials on a more or less 50-50 basis from the United States and the United Kingdom.

Before the war the plating industry in the Union was a rather haphazard affair, with little or no control over quality. Today, our South African Bureau of Standards is busy forming specifications regarding the quality of manufactured goods, and plated articles meeting with the Bureau's quality requirements will soon bear the official quality mark issued by the Bureau to approved products. Any lad who wishes to become a fully fledged electroplater will from now on have to pass through a five year apprenticeship in the trade, and he will be required to pass examinations at the end of each year of apprenticeship. Time for schooling is allowed by his employers on full pay.

The Plating Picture Today

At present we have factories in this country specializing in the following branches of plating: Steel furniture; cycle manufacture; silverware; cutlery; hard chrome-plated pneumatic mining equipment; suitcase locks and fittings; builders' and plumbers' hardware, including faucets, locks and door-trim; electrical domestic ware; stoves (electric and coal); beds; stretcher-cots; bolts and nuts and kindred articles; anodized aluminum; electrical switchgear; toasters, hot plates; domestic boilers; gas welding equipment and instruments; automobile-trim; hubcaps and bumpers, etc. There are shops that specialize in anodizing, with dyed work. Other branches are printing rolls, stereos, etc., railway-coach-trim. And in line with the fact that the Union's industrial sphere really began with gold, we now have factories for the production of goldware — the articles being made out of solid metal, and strangely enough, plated with gold to enhance sales appeal. We also have a factory manufacturing jewelry in gold. These people have been electropolishing for many years, without knowing that they must have been the first in the electropolishing field in this country.

The Union's plating industry has made a few important contributions to the business, such as a method of anodizing the inside of fabricated aluminum tanks; also the anodic blackening of zinc to produce fine wearing qualities. The development of our industry is, however, somewhat limited by the size of population. Our production is for the supply to only part of our 2,000,000 whites, for a considerable quantity of plated goods is still imported. The natives, at present, do not want plated goods, with the exception of bicycles. They have customs that are distinct from the customs and living conditions of the whites, and the vast majority of them ignore the modern way of life, and the accumulation of luxury goods. They work in the towns for a year or two, then go home to the rural districts, and live on their accumulated cash, only returning to the towns when their money has been spent. They then work to accumulate more, and subsequently go home to rest again. I am not at all sure that they have not got a far better existence than we whites, whose life is one continuous scurry for money and lust for worldly possessions.

The fact that the plating industry in this country has so small a market has prevented us from modernizing to the fullest extent in our manufacturing processes. The small demand has prevented us from going in for many automatic polishing and plating machines, for instance. All the polishing is done manually by the natives, except in the railways, where polishing is regarded as a trade deserving of the employment of whites.

Humorous Plating Experiences

On the other side of the plating business I might mention that in the early part of the war, we received a telephone request, asking what temperature we used in cadmium plating. Sensing that there was something behind the inquiry, we asked why they wished to know the temperature.

"All the parts are breaking," we were told.

We explained the treatment for hydrogen embrittlement, and then later we were telephoned by the maker of the alleged faulty parts, who declared that his springs were as good as any made anywhere in the world, and he considered it was the treatment they were getting in plating that was at fault. We were able to process a complete batch of his products — several thousand articles — with only one failure, and the manufacturer immediately claimed for all those items which had been rejected after being plated by other operators.

Another military trained plater found his plated parts giving poor service, and when we demonstrated hydrogen embrittlement by plating wood screws and fracturing same by screwing them into a hard wood block, he said: — "Hydrogen embrittlement? When was that invented?"

I was once sent some aluminum alloy, with a request to anodize 0.010" on

(*Continued on page* 121)

The Robinson Deep, another of South Africa's famous and one of its oldest mines, is still an active producer.

(Courtesy Pan American World Airways)

Spain

By Vicente Massuet Grau*

SPANISH industry in general, and electroplating in particular has had in the last ten years considerable development in spite of the difficulties and vicissitudes caused firstly by our Civil War, by World War II, and finally, by the diverse situations created by both.

The Spanish electroplating industry operates at present some 550 workshops devoting their activities to the treatment of pieces on behalf of other industries, plus about 800 plating plants owned by diverse companies and used for their own necessities. The low proportions of the latter in comparison with the former may be surprising; this is due to the fact that many Spanish provinces are not very industrial, do not have strong enough local companies which may need a private installation. At present however, there has been noted a strong tendency to diminish the number of workshops devoted to job-plating and on the other hand an increase of companies installing plating plants for their own use. Nine different concerns supply maaterials for the industry, of which only two have workshops where the most common machinery may be produced.

Electrical Equipment

Dynamos of special types for electroplating (up to 2,000 amperes output) are being constructed in Spain and one of the largest companies also produces selenium rectifiers up to 10,000 amps. Rectifiers have succeeded in all cases where dynamos were formerly used, and nearly all new plants are being installed with rectifiers, to the point where in the near future the construction of dynamos may be paralyzed. Although rectifiers are more expensive, they are, notwithstanding, more sought for. The most common types of rectifiers are of 500 and 1,000 amps. at 7.5 and 15 volts, and practically all of them are prepared to work with oil refrigeration system and thermostatic control of temperature. Regulation is established by tappings selected at the transformer and some time with more than 60 points of regulations. In some cases auto-transformers are inserted, which allow still better regulation. With the working conditions in Spain, I believe that, even though more expensive, the oil refrigeration system is best; moreover, it permits greater protection against the surrounding atmosphere.

Chemical Products

Normally, we import all salts to prepare plating solutions with, but in such periods as the present times, imports are restricted and practically confined to bringing in only the basic products, such as nickel sulphate, copper, zinc and cadmium cyanides. Spanish-made products of acceptable qualities are chromic acid of a 99% purity, copper and zinc sulphates, and all kinds of degreasing solvents, including trichlorethylene.

Supplying countries for plating chemicals are Great Britain and lately, Holland, France and Germany. So far, purchases from the U. S. have struck against the difficulty of obtaining dollars, which the Spanish Government must use to import other supplies considered of a greater interest to the country. The annual necessities of all kinds of chemicals, machinery, etc., might be rated around $500,000.

Plating Solutions

Nickel baths are in general of the room temperature still type. Only some bicycle, sewing machine, car and airplane parts factories have hot solutions, generally Watt's type with movement of pieces and continuous filtration. As a general rule, results obtained with still baths are not very good, nor can the resulting protection be considered excellent. With warm solutions, results are able to stand comparison with results obtained in other countries. The only difficulty that has been found in this kind of bath is pitting, which is avoided by periodic purification, addition of hydrogen peroxide, pH regulation, control of metallic content, etc.

Recently, we have started the first circular semi-automatic plating machine, and another is being installed at the *Empresa Nacional de Autocamiones* (the former Hispano Suiza). This

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View of part of the plating department at Marconi Espanola, S. A.

plant includes bright nickel solutions of the nickel-cobalt type and copper solution similar to the Du Pont type.

Upon the results of this installation will depend whether or not the system is taken up by other Spanish industries, although there are not many with sufficient working capacity to justify these equipments.

Chromium solutions are prepared with Spanish made chromic acid; in some cases acid of U. S. origin, which is highly reputed and much looked for, is used. Concentrations in solutions for decorative plating purposes are generally about 350-400 grams per liter, and only in hard chromium solutions 250 grams per liter concentrations are used. The SO_4 content is of the order of 1 100 and an excess can be rectified by addition of lead chromate or barium carbonate, both products abundant in this country. Solutions are worked warm, although little by little many have adapted their working norms to surrounding temperature except on the coldest Winter days, which are not many in Spain. Low temperatures are not very frequent in winter; it ranges between 20 and 26° C. The results working with these temperatures, and conditioning to the same the current density, are almost identical to the baths which are worked at 40° C., for instance.

Chromium plating is almost exclusively on nickel plated surfaces, buffed and generally degreased by hand or electrolytically in soda and cyanide. Trials to chrome plate brass or copper surfaces for cheap jewelry purposes have not been successful. Vats for chromium plating are of antimony lead-lined steel, as effort to use only pure lead have failed.

Hard chromium plating was introduced in Spain by the author in 1940 as a result of the inability to obtain here some special kinds of steel alloys, which could be substituted for by common steels with hard chromium coatings. There are five shops in Spain devoting their activities to hard chrome job-plating, and some military, aviation and automobile material manufacturing concerns operate their own hard-chrome installations.

The protection (masking) of those parts in the pieces which must not be plated is achieved by means of varnishes, or, alternatively, using an imported plastic tape.

Anodizing

Anodic oxidation is increasing its popularity parallel with increases of aluminum importation. The process used in nearly all installations is that of sulphuric acid.

Speculum Plating

One of the most modern processes which has been most successful in our country is the deposition of speculum, especially in the manufacture of tableware. The Barcelona concern *Metales y Plateria Ribera, S. A.* has vats for more than 3,000 liters of solution and a daily production of about 1,500 items with a 0.0125 mm. thickness of coating.

The speculum bath and its general characteristics and composition are well known by the readers of this *Metal Finishing*, which has already commented on the same. Its advantages over silver plating are many, and among them, its greater hardness and reluctance to tarnishing. Moreover, in this country it is much more economical than silver, although also more delicate to handle. The solution is affected by impurities, most particularly by lead, antimony, arsenic, sulphur, and divalent tin, although operating with rigorous control, constant and excellent results are obtained.

Electropolishing

Electrolytic polishing is beginning at present to have some importance, particularly for aluminum, although the present installations are performing on a small scale. However, electrolytic polishing of nickel has been used over 10 years in small plants devoted to the finishing of cheap jewelry articles. It is curious to note how in some regions, and particularly in the Valenci province, some very small companies have obtained excellent results and acquired much valuable experience. The solutions mostly used are the sulphuric/citric acid or the sulphuric/phosphoric acid types.

Phosphating

Phosphating is being developed in Spain by three companies. The process has not yet achieved the development which corresponds to Spanish industry, but it is being used privately by concerns making aviation, naval and warfare materials and equipment, typewriter and sewing machines, bicycles, etc.

In summary, we may point out that in the general aspect of machinery and materials for electroplating, Spain has advanced considerably. Perhaps it has been in polishing operations and preparation of surfaces where there has

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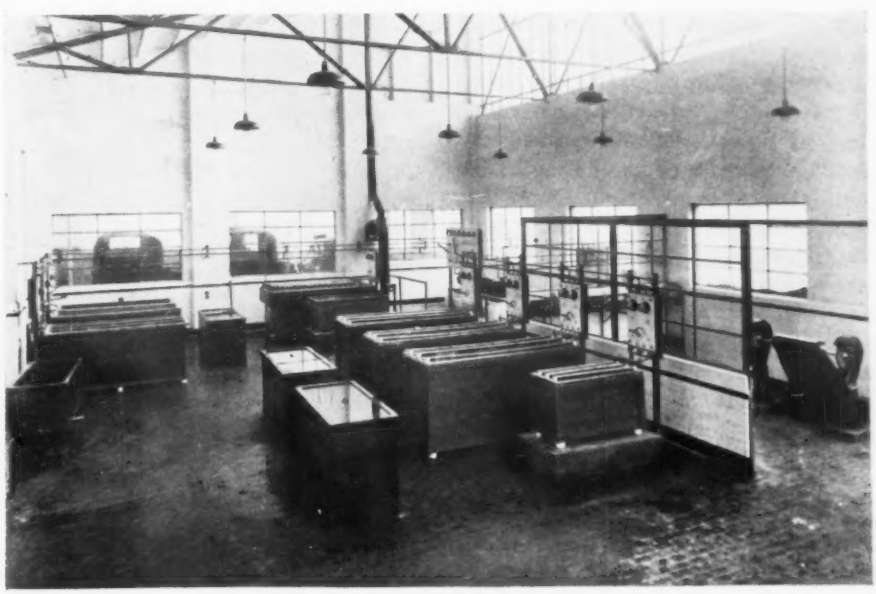


Plating equipment at the plant of a Spanish truck manufacturing firm.

(Courtesy Swedish National Travel Office)

General view of Riddarholmen, one of the oldest parts of Stockholm, Sweden.

Sweden

By Helle C. Qvarnstrom

THE plating industry in Sweden has grown considerably during the last decade. The number of job shops has multiplied and many of the larger and middle-sized manufacturing companies have added plating departments to their cycle of operations or enlarged or modernized their old installations.

The isolation brought about through the war made research a necessity in various fields of metal finishing. The labor shortage and the increasing labor costs forced managers to look for faster and less wage-consuming production methods. Bright metal deposition is now firmly established in most plating departments and shops; semi-automatic plating machines are frequently found in the larger installations. The latter are of two types: the circular, originated by *Riedel* in Germany after the principle of a "merry-go-round"—and the elliptical type corresponding to those prevalent in the U.S.A. Full automatic plating machines for general articles are, to my knowledge, not used at present—although good constructions are available. The limited market of a small country does not permit the production of sufficiently large quantities of standard articles to warrant the expenditure for full automatics.

Three full automatic plating machines of a novel design are now being built according to a recent report. This construction employs an overhead rail, which is vertically curved upwards at the different lifting-stations. Simplicity of mechanism makes it most attractive in price compared to conventional types, as the cost is roughly 50c less.

Specifications for quality of electrodeposited metals are adopted by I.V.A. (*The Royal Swedish Academy of Engineering Sciences*) and follows the specifications adopted in England and U.S.A. The testing methods for thickness are the same as those used by English and American platers. Various types of wage incentive systems are more or less successfully used in the plating trade here. Barrel plating is generally paid per kilogram goods produced and also charged the customers according to weight. Incentive wages on articles plated in still tanks cause the plating foremen most worries on account of the great variety of size and shape of the different objects to be plated. The most successful solution of this problem and a simultaneous production booster was the adoption of the rack unit. This rack, 3-4 feet long, eliminates the multitude of different incentives used in manual still tank plating and gives one standard unit.

For degreasing prior to plating, cleaners of the alkaline type are generally used. For exceptionally greasy or oily articles, trichlorethylene or similar solvents are used, as well as emulsion cleaners.

Buffing and polishing operations have undergone few changes, except that belt polishing has secured a firm position for certain classes of work. Cold glue and synthetic abrasives are used extensively for set-up wheels, but for finer grease finishing of certain metals natural emery and hide glue is favored.

Nickel plating is generally used for finishing all metals, although bright zinc plating to a large extent is applied to steel articles. The dull nickel solutions used are generally of the Watts type, with or without agitation and with electrolytic or depolarized anodes. The solutions are filtered continuously or at regular intervals. The bright nickel solutions were introduced here before the war, but were met with distrust by many platers, as some solutions could not be controlled effectively. The cobalt bright nickel solution was more successful, but the outbreak of the war stopped the source of cobalt sulphate. With the introduction of an organic type of bright nickel solution, which has now been in operation for many years, the previous resistance has been overcome.

Bright zinc plating has its natural market for steel objects, and the introduction of efficient bright dips has widened its field of use. Acid-zinc plating has decreased substantially except for continuous zinc plating of wire and for the production of zinc plated steel sheet.

Copper plating is extensively employed as an under-coat to nickel and chrome on automobile parts of steel. Acid and cyanide (standard or Rochelle) solutions are both in use, and cathode rod movement is often employed. Brass plating is used to a lesser extent in general plating shops, but certain manufacturers of ornamental articles made of zinc obtain decorative effects by coloring the brass plated object. Furthermore, brass plating is employed subsequent to bright nickel on many articles of cold drawn steel to give a bright gilt finish.

Chrome plating and hard chrome plating are both standard practice in this country for their respective purposes. The decorative chrome is usual-

ly deposited on an under-coat of bright nickel or buffed dull nickel. Hard chrome plating is used extensively on tools, especially for plastics, and on rolls, saws, pressed steel plates for wall-board manufacturing, worn machine parts, etc., and its demand in the market is growing steadily. The sulphate catalyst is generally used, but some plating firms employ others or a combination thereof.

Tin plating is to some extent used on electrical cooking utensils, cooling coils of copper, and as protection in nitrogen hardening, etc. The solutions employed are the sulphate and alkaline types, and for thinner deposits, the citrate bath.

The demand for cadmium plating has decreased owing to the high price of this metal, and part of its market has been taken over by bright zinc plating.

Lead plating is not a major plating operation in this country, owing to its porosity unless excessive thickness is applied.

Silver plating is applied to tableware and similar articles, and on radio and electric contact parts. The solutions used are standard cyanide and the Wood's type. Cathode rod agitation and cloth anode screens are often employed. Brighteners used are of two types, viz., semi-bright and full bright. The latter, which is of German origin, gives a deposit that is somewhat brittle when engraved upon but requires no coloring or burnishing.

Gold plating in cyanide gold solutions is used on jewelry and tableware.

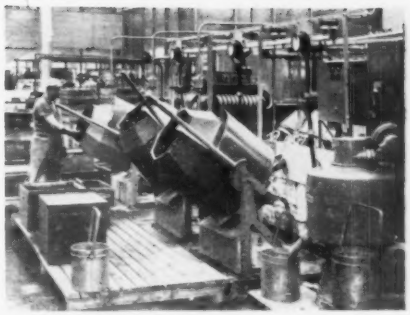
Anodizing has not developed to that extent which is promised. The reason for this is not clear, as so many articles could receive a decorative and sales-appealing effect with this finish. It is, however, extensively used for airplane parts and other technical purposes. Both the sulphuric and the chromic acid types of baths are employed.

Electropolishing is not used in production as yet, but promising results in pilot plant operation will give it a future in finishing wire products and similar articles.

Phosphating was extensively used during the war for rust-proofing equipment by the Army and also as a drawing lubricant. A special oil was developed to ensure good rust resistance of the phosphate coating.

Coloring of metals is not so popular as formerly on architectural metal work such as doors, window-frames, etc. Stainless steel with a brushed or buffed finish has proved superior in many respects, and more in accordance with modern style. Black oxide on steel is used to some extent. The solutions used differ somewhat in composition but are highly alkaline and contain an oxidising agent. Black nickel plating has lost much of its previous market in the decorative field and is practically limited to instrument parts for optical purposes.

Barrel plating is widely used on various small stamped and machined articles such as screws, nuts, bolts, washers and other mass-produced objects. Brass and copper goods are generally nickel plated, where as steel articles are preferably bright zinc plated. Also brass, tin, lead, copper and silver plating in barrels are common operations. The nickel solutions used for barrel plating are generally the old double-salt solution in high concentration. Bright zinc barrel plating is the favored treatment for products of steel, and the bright finish obtained is comparable to bright nickel plus chrome, at a fraction of the cost of the latter.



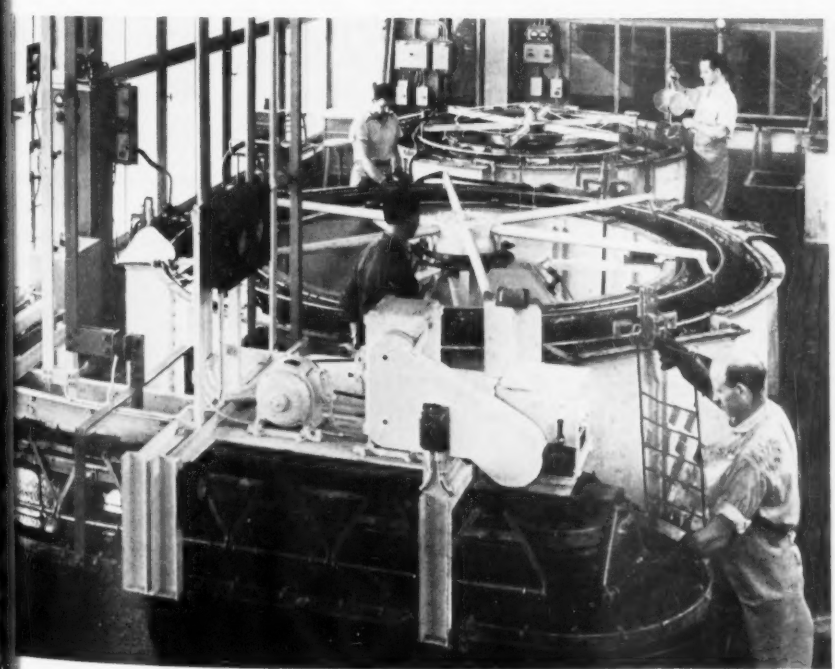
Barrel plating department for nickel and zinc at L. M. Ericsson Stockholm plant.

The open, tilting type, barrels are not popular, but for bright zinc plating these are sometimes equipped with separate cooling aggregates, viz., motor-driven pump and container with coils. The horizontal barrels follow the designs of the L.P.W. in Germany and modern American types. Chromium plating barrels of the old L.P.W. construction are in operation at a few plants, but the demand for this finish does not seem to warrant further installations.

Heavy nickel deposition for engineering purpose is carried out on a commercial scale by a few plating firms here, and this market is growing, although metal spraying offers keen competition. One company has successfully salvaged badly corroded drying cylinders at a paper mill by heavy nickel deposition. They were treated "in situ" owing to the enormous weight (40 tons and size (L. 14 ft. Dia. 11 feet). The amount of nickel deposited varied from 1200 to 1700 lbs. for each cylinder!

The author has also had a report of a successful plating process for aluminum cooking utensils, such as coffee-pots, etc., with nickel and chrome without the use of pre-dips of the zincate

(*Continued on page* 122)



Semi-automatic nickel and zinc plating of telephone parts at L. M. Ericsson.

(Courtesy Swiss National Tourist Office)

Switzerland

By Henry Reymond

Electroplating Consultant, Bienne, Switzerland

THERE are in Switzerland a few more than 500 installations for electroplating. These installations are not similar or even analogus with one another, which shows the diversity and the demands of the Swiss industry. The industry supplies on one hand the domestic needs and on the other hand, the larger part, produces for exportation.

The domestic market for plating has numerous and diverse requirements. The need of very finely finished manufactured products is very great. However, do not forget that the country has a continental climate, in spite of the relatively small distances separating it from the neighboring seas. This climate is much less harmful to metal coatings than are the salty climates or the climate of a country with heavy industries. The result is that the treatments applied to the articles of current usage in the country, do not need to be of superior quality. An exception is made however, for plating destined for use on railroads or for the Army. It may be stated, however, that the quality of the plating on imported articles in the last few years has slowly awakened the interest and demand of the Swiss purchasers.

The export demand for electroplated goods is principally in the timepiece business (more than 90% of the total production), electrical and scientific apparatus, and the machine tool industry. The requirements of this market are quite different than those of the domestic market, and it is not surprising to find that of the 500 electroplating installations, about 100 work on nothing but clocks and watches or jewelry. It is essential that instruments and scientific apparatus for export are treated properly, and very heavy plates are used on mechanical parts.

A trip through the various plants using electroplating will enable us to make a few remarks and some comparisons with American procedures. As a basis for comparison, it will help to state at the start that the consumption of nickel anodes in Switzerland does not exceed in one year those of England for one week, and what those in Switzerland would call a very large annual production would scarcely be considered a daily production in the United States. This fact is established in order to judge the possibilities and necessities of our finishing industry. It is also one of the reasons why American methods have exerted such a feeble influence on Swiss electroplating techniques. Germany is at our door knowing what is expedient and that which we desire. This country (Germany) was up until 1939 the large supplier of all products, apparatus or procedures. No other country was able to compete with the Germans. But Germany had eliminated little by little those items which the Swiss plating industry needed, with the exception of those acquired in 1935. She thus has a serious hindrance to recovery of the Swiss market. It is not surprising to see Swiss industry in the last few years turn to the Anglo-Saxon countries in order to examine the progress made and try to adopt the new methods to the extent possible: this with a very objective approach, with much prudence and often with suspicion. This distrust is often justified by the disregard on the part of the overseas suppliers for European habits. The one Swiss industry which is autonomous, using exclusively as it were its own methods and its own procedures, quite different from those of Germany or England, is the clock industry. We will discuss it later.

When one examines the domestic markets of our country it is necessary to remember that the Swiss appreciate an article of well finished appearance, but that the production costs of small lots prohibits, most often, the replacement of a worn or defective article by a new one; thus arises the necessity of having it repaired by an artisan and refinished. By deducting the installations of the watch making industry which we will examine in more detail a little later, we are able to estimate that there are about 400 electroplating shops in Switzerland of which nearly 150 are refinishing shops. A few here and a few there use some methods and some procedures which are nearly the same. Scarcely five are equipped with a modern method for working in series (in small series, certainly). Automatic installations similar to those

in the U.S. do not exist, as one may imagine.

The polishing shops are in general provided with excellent ventilation installations, for the laws protect the well-being of the operators. Even though the methods have remained the same for twenty or thirty years, piece work and the skill of the operator have allowed us to obtain a satisfactory price and quality. The small repair shops handle a great variety of products and demand a variety of polishing machines. No trade is any more conservative and the operator is more important here than the technique; this is the reason the shops are so similar to one another and so seldom open to new methods.

The supply of direct current to the galvanic baths, as the electroplating baths are properly called, was principally supplied before the war by converters of foreign production, generally German or Italian. Our electroplating industry considered the necessity of constructing commutators capable of replacing the dynamos ten years ago but it seems that it (the dynamo) has conquered the market.

Electroplating is used mainly in the manufacture of medals, and as for copper and nickel deposits, in the shops of the graphic arts and installations for thick deposits on machine parts (*Fescol* type). The methods and processes are not very different from those used outside the country. Hard chromium is widely used, which is not surprising in a country specializing in the construction of machines and machine tools.

The methods of preparation for electroplating generally consist of degreasing in organic solvents (usually trichloroethylene) followed by a degreasing in lye and a cold electrolytic degreasing. There was a struggle noticed several years ago between electrolytic degreasing with pre-copper plating and without pre-copper plating, followed or not by a sulfuric electrolytic pickling. The two methods have their advantages and their disadvantages and do not succeed in proving either to be detrimental.

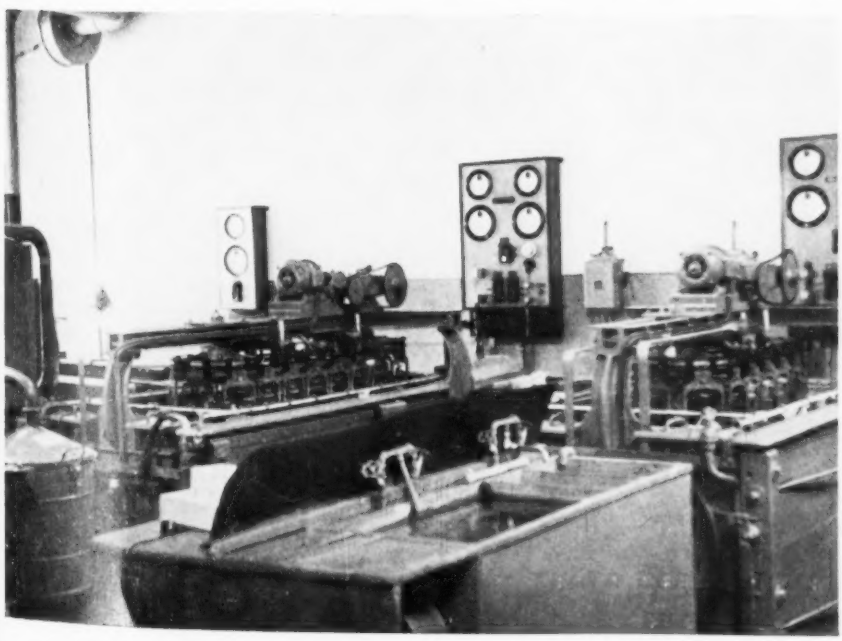
The greatest criticism which may be directed at our electroplating operators is on one hand the general disregard for control and correction of degreasing baths, and on the other hand the failure to see the need for complete neutralization or as complete rinsing as possible. Alkaline cyanide dips like cold water rinses, are practically non-existent.

The ferrous metals are coated with cadmium, (sometimes with zinc but in much smaller quantities), or nickel (followed or not by chromium). The cadmium electrolytic baths, although quite numerous, are small in volume. The majority of the deposits are less than 10 microns (.0004"). Zinc plating, dull or bright (American process) was just introduced during the war. After having lost its importance it regained a little of the field from cadmium, which commands an excessive price. The latter has retained its position, however, for the mass treatment of pieces of steel and iron. On this subject, we will comment that for deposits on small pieces in bulk, the jar type apparatus is much more common in Switzerland than the barrel type. This holds for nickel as for cadmium or copper.

A look at the rugged terrain of Switzerland gives one an idea of its transportation problems.

Nickel plating of pieces of iron or steel is commonly accomplished in baths of moderate concentration (16° Baume) and tepid (35° C maximum). Agitation as well as continuous filtration are again the exceptions. The deposits measure about 20-25 microns (.0008"-.001") with or without an intermediate plating of copper. This copper plating is most often done in an acid bath; hot alkaline baths for copper plating before nickel plating are seldom used, because above all the cost of such a treatment is too high in a small series of pieces. These nickel deposits, well polished and well chromed, make an excellent impression, but their resistance nearly always leaves something to be desired, as either the films are too porous or the adhesion is inferior on inexpensive articles. It is noticed that plating which is quite satisfactory in Switzerland because the climate is less corrosive or that the article is better cared for, is unsatisfactory in another country. For this reason one notices a clear tendency to increase the thickness of the film of nickel and to change the deposit

(*Continued on page* 121)



Partial view of the plating operation at Magnetos Lucifer, Geneva.

HICKOK Was Skeptical...

Then They Tried

TRUSHADE 24K Gold and Alloys

Gold plating at HICKOK has long been a major operation. Over the years many materials and methods were tried under the most exacting standards in order to insure uniformly high quality and maximum economy. By 1943 HICKOK felt they had stabilized these procedures to the point where, in their opinion, maximum economy and control had been realized.

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These quotations are from HICKOK'S letter to Technic Inc. date March 2, 1950.

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AUSTRALIA

(*Continued from page 77*)

craft parts, gave Australian platers their first large scale experience of rigid specification plating which was intensified when the Australian war effort shifted to New Guinea and the Pacific zone with their extremely severe corrosive conditions. Both during and since the war, the Standards Association of Australia has drawn up or endorsed a number of plating specifications which are finding increasing use.

Plating Research

Electroplating research work in Australia is not great in extent. The Commonwealth Government, however, has set up a well equipped electrodeposition laboratory as part of the Defense Research Laboratories, Maribyrnong, Victoria (with branches in Adelaide and Sydney). The primary function of these Laboratories is that of assisting with the technical requirements of Government factories and the armed services, but time is also found for helping and advising the industry as a whole. Platers make use of the Laboratories for advice on the many problems which continually occur, and for guidance in the application of newly developed overseas processes and techniques. The Laboratories keep the trade posted on these development through the medium of a small two-monthly publication "Plating Notes".

Plating Training and Education

Three of the state capitals, Sydney, Melbourne and Adelaide, have active branches of the American Electroplaters' Society with a total membership of approximately 300. These Branches keep platers in touch with the latest advances in plating, and the regular monthly meetings and social events run by the branches are really appreciated as occasions for the interchange of ideas and information. Parallel to these technical associations are Trade Associations connected with the Chamber of Manufacturers in each state, where plating shop owners get together on business matters. These latter associations are no doubt somewhat similar to the American National Association of Metal Finishers. Training of apprentices to the plating trade is carried out at Technical Schools in the major cities, but electroplating as a science has not yet received its rightful degree of consideration from the

state universities either from the training or research angle.

To conclude, it may be said that the approximately equal balance between jobbing shops and manufacturers' plants seems to be working satisfactorily.

The abnormal economic and industrial conditions which followed the war have been successfully weathered and an adequate degree of stability in the industry has been achieved with the result that the community's plating requirements are being more or less effectively met. In addition, there is a widespread appreciation among platers of the importance of associating for the interchange of ideas and of being informed of the latest developments. Briefly, the position is healthy and a bright future may be forecast with confidence.

CHINA

(*Continued from page 83*)

ately, the local authorities are beginning to take this problem seriously, requiring that exhaust systems be installed in every shop, and those shops located in congested residential districts have to be moved to less crowded quarters.

Enameling and Painting

Practically all enamel ware manufactured here is vitrified enamel. It consists of wash basins, saucers, dishes, vacuum-flask shells and miscellaneous household articles. There are in all forty-seven ovens, but only two-thirds of this is now in operation. The frit and milled enamel is prepared here. Black iron sheets are used as base. After stamping, the parts are cleaned, washed, and dried by heat to remove the grease and oil; no acid dip or strong cleaning operations are being used. The parts are then dipped into the enamel, and only the very best parts use a primer. Designs are spray painted after the base enamel is fired. The oven uses diesel oil as fuel and is not continuous. The parts are put into the oven by batches. Oven temperature is from 800°C. to 900° C.

In close relationship with vitrified enamel, those parts that are subjected to less severe services are being spray-painted. For aluminum, the parts are anodized first, dyed, and then polished to the desired finish. These latter two methods of metal finishing are gaining

cheaper products for the benefit of the platers.

No effort has been made here to discuss or point out the merits or demerits of the technical aspects and manufacturing processes as practiced in Hongkong. This article only tries to describe the conditions as existing here. To a visitor accustomed to mass production, or to the recently built plating plants in Detroit, a first glance here would give an impression of plating twenty or thirty years ago. But, taking into consideration the conditions mentioned in the first paragraph and other economic problems, the platers in Hongkong are doing a good job. Obstacles to the full employment of the up-to-date more efficient machinery are cheap labor, insufficient capital for expensive outlay, high interest rates (24% per annum), uncertain market (ever-increasing import-export restrictions) and lastly, lack of experienced men. Of course, there is plenty of room for improvement by the use of better materials, better and uniform quality control, and numerous small items that help to speed up production. In recent years the industry is more quality conscious and more interested in newer and better equipment. Larger firms are sending their younger men abroad, to Britain and to America. With these younger men and to those that are ever striving to produce better things cheaper lies the future of the electroplating industry in Hongkong.

ENGLAND

(*Continued from page* 85)

popularity, due to ease of application and simple equipment required.

AVAILABILITY OF SUPPLIES

With the exception of labor, electricity, fuel, sulphuric acid and some miscellaneous items, the metal finishing industry imports all their supplies and equipment. These supplies and equipment are imported both from the United States and England, sharing the market equally between them. The former has the advantage of quicker delivery and faster freighters to deliver them, while the latter is favored by lower prices and its qualification to obtain an Imperial Preference within the British Empire. Consumers of plating supplies here are very brand conscious. This is partly due to prejudice and partly due to lack of a thorough knowledge of the products and tools they are using. This is the reason why ready-mixed salts and solutions are preferred. However, as competition becomes keen and profit margins begin to narrow, this brand consciousness is wearing off, paving the way for better and more efficient products. This fact is supported by the rapid increase in sales of the plating supplies department of the author's firm, *Kam Wah Hong*, who entered the field in 1948. Before the War there was only one firm who capitalized upon the brand consciousness of the platers to monopolize the plating supply market. Since the war, no small effort has been put to break this monopoly, and at present there are quite a few plating equipment and supply firms introducing better and electro-deposition, comparatively little had been done in the field of rectifier development. Copper oxide and cupric sulphide rectifiers of small denomination only were apparently being used, and one of the explanations for this curious anomaly was that the insurance risks attaching to oil-containing apparatus was looked at askance by underwriters and works executives alike. While, of course, there is always an element of some fire hazard, it may interest American technicians to learn that during the whole of the period in which oil-cooled selenium rectifiers have been used in this country (covering over one million amps in output), no difficulty whatever has been experienced with respect to fire; and it should be appreciated that precautions

taken in British factories against accidents bear comparison with any country in the world.

A very interesting development in the last year or two has been the intensive work to produce control equipment which would make is possible to set a master control unit with predetermined characteristics, so that components placed in the plating bath would receive the same current density, irrespective of their shape or sequence of loading in the vat. It will be appreciated that this is one of the major difficulties in plating procedure, in that it is far from easy to determine comparative areas of components differing widely in shape and size and to set the variable resistance so that the correct current is applied. Already the work which has been done to date is so encouraging that it has been possible to set a master control apparatus of the type indicated to control a given bright nickel vat and to pass articles of varied shape through this vat without the operator having to alter the current conditions in any way; in such a set-up it has been possible to achieve uniform current densities within a comparatively small margin of error.

Electro-Polishing

The development and application of electrolytic polishing in the British metal finishing industry has made some progress, but it must be admitted that this progress is much slower than had been originally anticipated. It has had some application for engineering purposes in the production of super-finishes. Its characteristics for producing a differential etch effect has also been made use of by employing the process as an inspection tool. On the decorative side, the process has mainly been applied in the field of stainless steel components and in the production of aluminum reflectors.

Protective Finishes

The main protectives for steel in the electroplating field continue to be cadmium and zinc respectively, and despite the disparity in price, it is surprising what a high cadmium consumption is still registered by the plating industry.

On the other hand, in some sections of industry the cost of cadmium is a factor which has to be taken into account, and there has been a notable move from cadmium to zinc plating, in consequence. Bright zinc plating has particularly interested executives who have rejected cadmium in favor of zinc but are still interested in producing a semi-lustrous finish. The use of passivating treatments of various kinds is very largely practiced today, particularly on components which have to resist tropical and other severe atmospheres abroad.

Tin Alloy Plating

Lately, considerable development work has been carried out, mainly by the *Tin Research Institute*, on possibilities of making industrial use of tin alloy deposits. It is largely to this organization that the development of speculum plating, the tin-copper alloy carrying about 40% of tin, is due. Speculum plating, which produces an attractive bright finish with relatively good tarnish resistance, has made slow progress, largely because there is always prejudice connected with the development of a binary alloy deposit, it being felt that the control of composition, both of solution and deposit, imposes difficulty in production. The fact that the two constituents of the alloy differ so much in color was again considered to be a disadvantage because with variation in current density, one could, in the early development of the process, produce variation in colors ranging from white to pink. However, these difficulties have been largely re-

solved, and installations which make use of speculum as a finish are adequately controlled so that an alloy deposit of high uniformity is regularly produced.

Other tin alloy deposits are receiving attention and are in the development stage, and more will be heard of these in due course.

Roto Dip Finish

An important development in the last two or three years has been the "Roto Dip" paint finish for car bodies. In the past, early corrosion failure of such components as car doors has been due to the fact that it has only been possible to apply finish protection to external metal surfaces, mainly by spraying. The result has been that internal surfaces were attacked by damp, condensed water vapor, etc., so that in a short time rusting occurred; the penetration of the metal being from the inside, not the outside exposed to the weather. The roto-dip technique ensures that a complete car body is immersed in the protective medium (Bonderizing solution, followed by primer, etc.) and all parts of the surface area, inside and out, receive protection. Plants are already in operation employing this technique in the works of motor car manufacturers, and further plants of considerable size are in course of active erection. The project is an important contribution to the production of quality finishes on British cars.

Plating Specifications

One of the thorniest problems which has engaged the earnest attention of the British plating industry recently is the question of setting down adequate specifications which shall be fair alike to the manufacturer demanding the specification and the plater who has to satisfy this demand. It has long been felt that the plating trade would be in danger of losing the confidence of manufacturers through the production of plating of poor quality. The problem is not a new one, and resolves itself into a question of economics. Ignoring altogether that small section of the plating trade which is unscrupulous and endeavors to cut deposit thickness to the lowest point which will be acceptable by the customer, the great majority of platers today realize that the reputation of the trade as a whole will be judged by the service which the plating can give. Hence, although specification plating was at one time an unpopular theme, it is receiving very close attention by all who have the reputation of plating at heart.

The other aspect of the problem is the fact that nickel plating, which is after all the most important process in the whole gamut of plating processes, is itself woefully inefficient, whatever the process which may be employed in producing deposits which achieve anything like mathematical uniformity. The throwing power of nickel solutions has without doubt been seriously reduced as a result of modern improvement in the directions of speeding up the rate of deposition, production of bright nickel, etc. Furthermore, it has to be realized that the serviceability of an article of complex contour will be reflected in the corrosion resistance of the most recessed parts of the contour, where the deposit is thinnest, and the modern trend of design has not been altogether kind to electroplaters in this respect. In this connection, much is already being done in collaboration and co-operation between the metal finisher and the designer. Thus far, however, we have rather been learning the "hard way," and much yet remains to be done before the implications of design are as widely understood as they must be if quality plating is to be standardized.

The problem is being tackled particularly by the automobile industry in this country, who use probably the largest amount of nickel-chrome plating, and it is likely that as a result of co-operation on all sides, specifications will be produced which will give

as near as possible the results required by the manufacturer, on the one hand, and will be as tolerant as possible to the limitations of the electroplater, on the other. The admirable efforts of the American Electroplaters' Society and the American Society for Testing Materials in this connection have been noted here, but it is felt that the last word has not been said in this matter yet. The author's view, in particular, is that it is relatively easy to set down on paper certain figures which represent an impressive looking specification, but the difficulty arises when those figures have to be interpreted in terms of the actual electroplated finishes.

RESEARCH

Finally, a brief word with respect to the research work which is being carried out in Great Britain. There can be little doubt that works executives are taking more note of the problems commonly encountered in plating practice, and that there is widespread appreciation of the useful results which have been achieved by research workers in the past. Development and research work are accordingly being carried out, not only in research establishments, but also in the countless works organizations up and down the country. We are hopeful that when all this information is garnered and eventually disseminated through appropriate and official channels in the next year or two, it will be realized abroad that this country, despite the difficulties with which it is afflicted, is more than maintaining its contribution to the progress of electrodeposition and metal finishing.

FRANCE

(*Continued from page* 89)

shown in Figure I all of the baths are situated side by side in series. On one side of the series of baths is found a conveyor track. For the baths of small dimensions, and light pieces, as in this case, the handling over each tank is done by hand. For large baths and heavy pieces the parts are managed by handling equipment. The other side of the series of tanks is reserved for piping of water, compressed air, vapors, electricity, vacuum, etc. The baths all have two standard dimensions, width and depth. The length is proportional to the processing time. The degreasing bath is equipped to receive two cathode bars; the rinsing baths can only receive one bar at a time; the electroplating baths allow the number of cathode bars appropriate to the desired production.

Each bath is served by a separate power source. The supporting bars for the anodes or cathodes are disposed perpendicularly to the conductors and receive either positive or negative current by means of appropriate sockets. The bars supporting the pieces are arranged in racks. In the photo may be seen racks full of pieces suspended from the conveyor.

Another interesting plating installation is shown in Figure II. In this set-up, the racks and operator are carried along the series of tanks on a chain-driven carriage. The operator controls the air lift and the direction of the carriage travel by levers on the carriage platform. At the end of the tanks the racks are placed on monorails, where the ball-bearing friction rollers mounted on each rack carry them to the unloading-loading station and thence back to the start of the plating line. This system of handling racks is applicable for baths up to 4 feet wide. For wider baths, the pneumatic hoist is mounted over the baths on dual rails, and an operator seated above the rails controls the lifting, descent, and forward motion of the racks. This type of installation is shown in Figure III. Also in this photo will be seen the centrifugal filters (Rotofilters) for each bath and the oil-cooled rectifiers required for power. This machine permits the production of 40 racks of finished work per hour. Two operators are working simultaneously on the overhead carriers.

It will be evident from the description of some of the more modern French plating plants that much progress has been made, and that suitable production equipment is available. All that is required is the large demand for plated goods to justify the expenditure for this equipment.

GERMANY

(*Continued from page* 91)

ently stable and present in optimum concentration.

Test Methods

For the electrolytic measurement of pH particularly in the alkaline range we have made good use of the bismuth electrode of *K. Schwabe*. The bismuth is separated from graphite or glass in a perchlorate bath or is fused into large bismuth rods under vacuum. It is useful for the measurement of pH in the range from 3-14. In order to determine the thickness of a galvanized layer, a modified BNF-Jet Test has been used.

The thickness of aluminum oxide layers may be determined by simple solution in a solution of 320 cc/liter of phosphoric acid and 160 g/liter of chromic oxide. It takes about five minutes to dissolve a layer 30 microns in thickness. The calculation of the thickness of the layer is then only accurate when the specific gravity of the oxide is known by determination by another method. It runs between 2.3 and 2.7. The base metal remains unattacked.

Personal and Company News

In the year 1945, *Professor Max Schlotter*, well known both in and outside of Germany as an investigator in electroplating, passed away. In 1948, the *Langbein-Pfanhauser-Werke A. G.* (the largest industrial electroplating concern on the European continent before the war) celebrated its seventy-fifth year in existence. The successor of the Langbein-Pfanhauser Werke in the German Democratic republic is the publicly owned factory *VEM Spezialwerk fur Galvanotechnik*, in Leipzig. In western Germany Langbein-Pfanhauser has established a new manufacturing plant.

The German scientist and technician is more in the clear today now that the important problems of all men are his—to work together in peace and harmony and to work together with the greatest of energy with each individual nation. Our one wish is that the political and economic picture of Germany will develop in such a manner that at the next International Conference we may participate as members of a unified German country, and to work as equal partners on the large international problems.

INDIA

(*Continued from page* 93)

machinery, etc., India has to depend mostly on foreign countries.

(b) Training People for Scientific Plating

At present there are few training centres for specialization in electrodeposition, and even in these centres the proper facilities for practical work are not available. The plating industry, except that attached to big industries, can hardly afford to employ the qualified technicians.

The plating section of the National Metallurgical Laboratory will be equipped with almost all the plating solutions and will not only give vocational training to the University students but also to those who wish to take plating as their career or are already engaged in the trade.

(c) Placing Plating and Finishing Methods on Scientific Basis

National Metallurgical Laboratory besides suggesting improvements in the existing plants, will also assist the industry with their individual problems.

Moreover, the services of the trained personnel will greatly help the industrialists in putting the plating industry on a sound basis.

The success of the plating industry will depend on the cooperation that the industrialists can offer to the National Metallurgical Laboratory. The keen interest already shown by some of the firms indicates that the industry will be placed on a sound basis and that Indian plated goods will have a good overseas market.

India-Part 2

By Bhupal Naha

THE origin of plating in India is one of the unravelled mysteries of the past. Archeological discoveries have brought out many centuries' old specimens of metal coating. Actually, for those days metallurgy as a whole was a highly developed industry in India, and treatment of metals in various ways for their preservation and beautification is found to have been an old practice of industrial art.

Barrel plating in a Calcutta job shop.

An iron column in Delhi, dating back to the fourth century A.D., shows the remarkability of its anti-rust treatment and speaks eloquently about the height reached in this respect. As to plating and metal coating, the best specimens of it are on art-wares, and it is very difficult to place the date of the very ancient beginnings of gold and silver plating. Besides gold and silver, brass and tin were also extensively used for coating on baser surface. Metal coloring on art-wares and utensils is still a flourishing industry in certain centres of the U.P.

So far as the modern electroplating industry is concerned, it made its small beginnings in and around the end of the nineteenth and the beginning of the twentieth century. The passage of about half a century has, however, shown little development. Whatever development there has been, has occurred in three well-defined stages. The second stage started about 1935, the third stage starting in about 1941, that is after the beginning of World War II. The three stages actually almost run parallel to the stages of the growth of industries in India, particularly of the metallurgical industries and machinery and other sheet-metal manufacturing industries. From the consumption aspect too, there have been three stages with about similar duration of each period. In the first period, plating was used only, or at least mainly, for decorative purposes in art-wares and utensils. In the second period, demand was felt for plating

Polishing section of a typical Indian job shop.

comparatively bigger-sized goods like tubular funitures and for plating or replating cutleries, sanitary fittings and parts of cycles and automobiles. It is in the third stage that industrial demand for plating arose.

Both the first and second stages of the growth of electroplating industry in India are marked by inefficient work done solely by technically untrained labor by methods of trial and error. The output naturally was not perfect. Job plating, which still accounts for much of the work done throughout the country, as yet remains mainly in the hands of such staff and workers. It was only in the beginning of the War that technically qualified personnel began to be available in trickles. It is no wonder, therefore, that equipments commonly used are not automatic and modern, such improved devices being used mainly in some of the new manufacturing firms which have installed plating departments of their own.

When electroplating began in India about half a century back in its modern applications, it was nickel and copper plating that were the order of the day up to the beginning of the thirties, when chromium plating made its appearance for the first time for decorative purposes. For nickel plating, double nickel salts were in use up to 1930, and thereafter imported prepared nickel salts were first applied. The dependence on imported chemicals in part accounts for this delayed application. Yet one wonders even today how illiterate workers in the main carry on the major portion of the work, and this with the application of most backward techniques and in very ill-equipped and unhealthy surroundings. However, the growing industrial demand during the last decade, specially during the War and since then, has helped much the modernization of technique and equipments. Paucity of imports and the need of self-sufficiency have forced the development of new industries, and along with them also of newer electrodeposition processes. Yet India remains largely dependent on foreign sources, mainly Britain, for the supply of not only the necessary chemicals but also most of the precision equipment and plants required.

Present Position

The present position of the Indian electroplating industry can best be gauged from the number and nature of factories and the scope of work in them. The industry, firstly, is localized in the few big cities and industrial towns in the different States, but the largest number of factories are working in Calcutta, Bombay, Kanpur, Madras, Moradabad, Delhi and some other places. In all, there are about 700 factories with less than 20 workers each, about 300 with between 20 to 30 workers each, and about 75 with more than 30 workers. Most of the small works are doing business in small shops maintaining only small vats for nickel, chromium, copper, brass, zinc and silver plating and have small polishing departments. In few or none of these is the plating or polishing shop well-ventilated, nor have any of them any up-to-date cleaning and pickling arrangements. Some manufacturing firms have in the last decade installed small workable plants for plating and polishing their own products; but few of them have modern polishing departments, polishing being generally done by manual labor and not by automatic devices. Of late, of course, some of these firms have in-

stalled polishing and plating barrels for plating their small products. Within the last two or three years some imported plants have been installed in some manufacturing concerns for hard chromium plating, anodising and phosphating. Some very up-to-date plants are going to be installed in new concerns that are going in for production in industrial lines which are new in this country, like cycle, automobile, and sewing machine manufacturing and electrical industries.

Important Concerns

Among the big manufacturing concerns, mention may be made of *Hindustan Aircraft Ltd.*, Bangalore, *Hind Cycle Ltd.*, Bombay, *Hindustan Bicycle Manufacturing Co. Ltd.*, Bihar, *Hyderabad Allewyan Metal Works Ltd.*, Hyderabad, *Textile Machinery Corporation Ltd.*, Calcutta, *India Cycle Manufacturing Co. Ltd.*, Calcutta, and the Government-owned *Locomotive Workshop* at Chittaranjan and the telegraph and telephone equipments factories in Bombay and Bangalore. Chrome and nickel plating is common to all of them, but in addition some have special lines. For example, *Hindustan Aircraft Ltd.* has also anodising plants just as *Hyderabad Allewyan Metal Works Ltd.* also undertakes phosphating and *Textile Machinery Corporation Ltd.* have installed hard chromium plating plants. Other firms in these lines also are not far behind.

Problem of Supplies

With the growth of the industry in the last decade, dependence on foreign sources for necessary supplies is being gradually eliminated. Before the War, British plants, equipments and materials accounted for almost all the available supplies. Even at the end of the War, Britain continues to supply about 80% of the total requirements. But indigenous production is gradually and steadily making headway. Plating and polishing accessories were already in limited production before the War. But the quality and volume of production has grown since then, and newer accessories of Indian make are on the market. The War proved to the hilt the difficulty of dependence on foreign imports. Under the stress of circumstances, therefore, increasing number of materials, including chemicals, are being produced in this country from Indian resources. Two or three concerns are at present manufacturing normal electroplating and polishing equipments and supplies in some quantities. But, as noted before, the majority of the requirements including all precision equipments continue to be imported from the U.K.

Further Development

In conclusion, it has to be pointed out again that it is miraculous how the increasing volume of work is being carried on in this country in the present backward conditions of the electroplating industry in general. But happily, further developments of this industry are expected to be sharp in this country during the next few years. These would depend, no doubt, largely on the world supply and trade position as well as the industrialization of India according to plan. The Government has at least filled up a big gap that so long existed in this country—that is, the newly established national scientific laboratories. The scope of research on Indian resources which they offer is sure to prove highly beneficial to this as to other industries. Mention may be made in this connection particularly of the *National Physical and Chemical Laboratories* in Delhi and the *National Institute of Sciences* at Bangalore. These are already reported to have undertaken some helpful researches from the standpoint of catering to the self-sufficiency of the industry in respect to the required chemicals from indigenous sources.

ITALY

(*Continued from page 94*)

ferred and is used for the building up of worn or undersize components. Hard chrome practice comprises cold cathodic cleaning, anodic etching, then plating.

Porous chrome plating is now being studied by a number of plating firms, but has not yet been applied in industry.

Lead plating is scarcely practiced, although many reports on industrial plating from the sulfamate bath are noted. In Italy the sulfamate baths are largely used for lead refining, with good results. Fiat does some lead-indium plating of bearings.

Tin plating, though not common, is done from the usual stannate solution. Tinning by immersion (in particular aluminum pistons) followed by subsequent electro-tinning, is increasing in favor.

Cadmium plating is now rare, but there is a lot of zinc plating done, using cyanide baths.

Silver plating is quite widely practiced, using the cyanide bath plus brighteners. Fiat applies thick silver plating over a nickel strike for aircraft parts subject to hammering.

Alloy plating is mostly brass (for rubber bonding), cobalt-nickel, and gold alloys (for jewelry).

Plating on zinc alloys is common, but there is practically no plating being done on aluminum. The only two unusual plating processes are the plating of cobalt-nickel and of rhodium, both from sulfamate baths.

Anodizing with sulfuric acid is widely done, and very often is followed by sealing and dyeing treatments.

Electropolishing is not yet being done on an industrial scale, although it is under active development in many laboratories. Continuous phosphating units are commonly used as a preparation for paint and lacquer finishes.

The laboratory directed by the author at the *Polytechnic School of Milan* is actively studying the following problems:

The "mechanism" of electrodeposition.
The influence of the base metal.
The influence of the anion and of addition agents.
Throwing power.
Anodic attack and passivity.
Electrolytic polishing.

These studies will undoubtedly give us a deeper knowledge of electrochemistry and its practical applications in Italian industry.

(Courtesy Pan American World Airways)

Leaning Tower of Pisa.

JAPAN

(*Continued from page 96*)

In addition to the above, metal-spraying, phosphate-coating, calorizing, bright-dipping, enamelling and cloisonné are in operation.

With the restoration of free economy, every growing attention is being directed toward metal finishing in Japan.

In closing, the author wishes to express his sincere gratitude to *Mr. W. A. Raymond*, editor of this journal, who kindly offered the space for Japan in this International Issue, and to *Mr.*

Jiro Takahama, editor of "Plating" (of Japan) who kindly presented the historical materials as to the origin of plating in Japan.

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LOW COUNTRIES

(*Continued from page* 97)

also some of plating equipment built in Great Britain.

With regard to Denmark in particular, there are a fair number of plants which are operated on semi-automatic lines, and at least one fully automatic plating machine has been installed. There is a great interest in bright nickel plating, which is being used more and more extensively.

During the war, brass plating was employed to quite a fair extent but the demand for this finish has now decreased. Zinc plating is used but only to a limited extent, while in copper plating, both the cyanide and acid solutions are operated.

Silver solutions for tableware, etc., are generally of the standard cyanide type, both with and without additional brightener. Metal coloring based on the production of copper sulphide coatings is used, for example, for the finishing of household fitments, lighting fixtures, etc. Anodizing of aluminum is quite extensively employed, particularly for kitchen utensils, etc., and barrel plating is a popular method of finishing the cheaper articles, and in general use in most plants.

American and British industrialists are realizing now that there are very marked opportunities for exporting technique, processes and plant to these countries, for which indeed there should be every encouragement, because such efforts can only redound to the benefit of all concerned.

SOUTH AFRICA

(*Continued from page* 101)

to the parts. A note was sent to the customer saying that our Dimension-Stretcher had broken, and we could not, therefore, carry this out. He cycled round post haste, to be first with the information, and to have a Dimension-Stretcher described. We became very good pals through that incident.

Authority in the early days decided — after an analysis of "Chrome salts," "Hard Chrome salts," and "Bright Chrome salts" (all proprietary), that they could find no difference in the formulae, and so the "difference must be of a very minute addition which did not show up in analysis." Hence they concluded that hard chrome plating could not be done without the "'X' Brand Chrome salts." We quickly made up a hard chrome bath, and submitted parts to the authorities. After a time we received a report to the effect that the parts appeared to be coated with a material which was as hard as chrome, but they asked if I would please refer to memorandum "XAAA," wherein it was stated that hard chrome plating could not be done without "X" salts. They informed us that if they needed any hard plate such as we were able to do, they would requisition for same. This they did, and during a period of five years the parts reached the six figure mark — but always the requisition was for "Hard Plating" — chrome was never mentioned!

In conclusion I would say that the plating industry in this country, is

now recognized as an important part of the manufacturing cycle, and to us — as it is to every one engaged in this work — the call is for a reduction in costs all the time. The personnel engaged in the work are learning fast, but we here are quite convinced that we shall never get to know all that is essential. In one direction, we South African platers are at a distinct disadvantage in comparison with you, our American cousins. The plating shops here (with the exception of Government establishments) usually have only one white skilled plater, the rest of the workers being unskilled natives, and if anything happens, the onus and responsibility all fall on one pair of shoulders. There is nobody but the consultant to fall back on, and so we poor platers in South Africa find that our hair goes gray very quickly.

SPAIN

(*Continued from page* 103)

been less advance; this is partly caused by the sometimes insurmountable difficulties in obtaining abrasives and greases in the necessary quantities and qualities.

It is regretable that circumstances have been such that the contribution of the United States towards the development of the Spanish electroplating industry has been almost nil. However, we must and do trust in the future and Spanish readers follow with real interest the developments made in the industry in the United States.

SWEDEN

(*Continued from page* 105)

or other types. The adhesion is claimed to be perfected by means of a special type nickel solution.

Insulating materials for racks and jigs used in plating here comprise plastic tape and lacquers, and to some extent plastic copolymers applied by diping or spraying.

The tanks and vats in our modern plating plants are made of the best materials available for the respective solutions used. Thus, for rinse and for water tanks, stainless steel is widely used, and also for nitric/sulphuric acid containers in bright pickling. For hydrochloric and sulphuric acid pickles an asphaltum/quartz compound moulded 4" thick with steel reinforcement has proved valuable and lasting. Nickel and acid copper tanks are generally made of steel and ebonised, or if very

large, lead lined with burnt joints. Chrome tanks are lined with wire-reinforced glass and acid proof cement or antimonial lead. Also bricklining is successfully resorted to for this purpose. Barrelling operations for deburring and finishing mass-produced articles are frequently used by manufacturers. The results obtained are very satisfying also for objects requiring a high degree of surface finish, and a wider application of this cost-reducing method is expected.

At one plant an automatic zinc plating unit for steel-strip was constructed on noval lines during the last war and successfully run for several years. The tanks were placed in a straight line, with air boxes separating each tank. High pressure blowers maintained sufficient pressure in the air boxes to prevent the different solutions mixing. For emptying the baths, auxiliary containers were placed underneath and refilling was a few minutes' work from the same air-source.

Electroforming has been carried out on a small commercial scale for some years. Thus, one firm deposits nickel on antimonial lead moulds with subsequent removel of the core by melting, producing knife-handles, chandeliers, etc. Another company produces reflectors by electroforming. Silvering of glass reflectors by chemical reduction and copper backing is also carried out to some extent. The use of low voltage generators is declining. Rectifiers of various types have been manufactured by different firms in Sweden for many years. The selenium plate rectifier is favored and has proved a dependable asset for the plating trade. The air-cooled type, which was introduced before the war, has in recent years received keen competition from the oil-cooled rectifier. As both have their merits, it will be hard to predict the type prevailing ten years from now. The potential fire hazard in connection with oil-cooled rectifiers will restrict its use in the factory unless a gravel-filled bed or other adequate safe receiver for oil leakage is arranged underneath.

The future for plating and metal finishing in Sweden seems bright and promising, and even if competition from new materials, such as plastics and stainless steel, is expected to increase, we believe there will be ample room for everybody. Manufacturers have found that an attractive finish on their products will more than pay its

costs by increase in sales. For our present knowledge of most factors governing electrodeposition, we express our gratitude to the men who have contributed in the plating departments, plant laboratories and research centers. Many gaps in this field are yet to be filled, and we look forward to what the next decade will accomplish towards this goal.

SWITZERLAND

(*Continued from page* 107)

by raising the temperature of the bath as well as by using continuous filtration.

These remarks may also be applied in part to nickel plating cuprous materials. Here however, the deposition of bright nickel in cold baths seems to have developed since the war. It is singular that it is on such metals that one notices the most numerous exfoliations of the nickel deposit. The majority of the baths are those called semi-rapid, therefore free from ammonium salts and heated to 30-40° C. The large majority have base of citrates with a sufficiently large proportion of an activating salt (about 30%).

The majority of the tanks are made of wood, sometimes lined with lead or sandstones. The maintenance of baths, unhappily, is done nearly everywhere in a very empirical manner and most often by primitive means. Men are needed in the trade who have sufficient scientific background, but many industrialists consider finishing to be a poor relative and do not place at the disposal of the electroplating shop the necessary means for normal supervision and maintenance.

Silverplating of brass or german silver is done almost exclusively for the hotels and local clientele. The methods are still the same as those used half a century ago. They are starting, however, to use here the hot rapid baths since the baths allow them to obtain bright silver deposits (according to the patents of *Weiner*).

Zinc alloys are colored by the deposits of nickel (or chrome-nickel) which protect it. The thickness of both the underlayer of copper (when there is any) and the deposit of nickel is rarely sufficient, and still more rarely satisfactory for quality. This is principally because it is desired to deliver such articles at a low price without considering that a poor treatment may be more expensive to our industry than a quality nickel plate. The most often baths for zinc alloys are those called neutral nickel baths (pH 6), but it seems that the new methods of nickel plating zinc are going to alter this state of affairs. This is necessary principally for the future of our exportation of articles of such materials. Aluminum is very rarely nickel or chrome plated.

Watchmaking Industry

It has already been stated that the watchmakng industry occupies a unique situation with respect to electrodeposition. Each part of a watch is or may be plated. The brass parts of the movement are polished, then silver plated, gold plated, rhodium plated, palladium plated or simply nickel plated. Steel pieces most frequently receive a very light deposit (.00004") of bright nickel, as nonporous as possible and sufficient for protection. The hands as well as the dials are decorated by various colored gold deposits or silver. Finally, the cases may be plated with gold up to 40 microns (.0016") but normally plated with 10-20 microns (.0004-.0008") of nickel or chromium.

All of these deposits should correspond to a color type which has been well established, and be absolutely free of defects, spots of all sorts (even microscopic), pits and waves; each piece is examined by experienced eyes under a magnifying glass. Such requirements impose particular methods both in the preparation and in the electrodeposition. It is thus that by a particular technique, although older

than half a century, we deposit on our Jura, on the lightly nickeled brass movements, an extraordinarily resistant light deposit of bright silver in a few seconds. The gold plating is done by specialists who are more artists than electroplaters: scientific research done on gold baths in the last few years has confirmed and explained nearly all of the methods found empirically by our watchmakers. But here, as in all of the Swiss electroplating industry, the fear of competition, egotism, and the lack of the spirit of collaboration of the electroplaters has impeded the rational development of methods of depositing metal coatings. When our people understand that they can and should work to help one another, the gravest defects and the largest difficulties will have been conquered in our Swiss electroplating industry.

Mexico-Part 2

By Tomas Rodriguez V.

Electrochemist, Industria Electriza de Mexico, S. A.

THE importance of electroplating in Mexico increases as time advances, due to the industrial expansion which has taken place in the last four or five years. As an illustration, I may mention that some 20 years ago, very few factories in Mexico did this type of work and, of those few the greater part of them performed the ornamental side of the work, and little consideration was given to the durability and resistance of the finish to various external agents. Almost no control was exercised over the solutions employed or to the finish applied; a pleasing appearance was all that mattered.

About 1932 *La Consolidada Company* installed a department (which I understand still exists), in accordance with the latest techniques developed at the time and employing the required chemical control. For this reason, I consider this shop to be the first in Mexico working under proper technical supervision.

Around 1934, great interest was displayed in chromium finishes and consequently in copper and nickel finishes, due to the vogue for chromium finished, tubular furniture. Many of the small shops established at the time for that specific purpose later closed up, but the remaining shops continued to improve their methods for control and operation and eventually developed into electroplating shops for general purposes, the majority of which are presently equipped to make various kinds of finishes, properly controlled by modern methods. As an example of the evolution undergone by a shop of the type mentioned, I may cite that of *Briones*, which manufactures furniture and which is currently operating in accordance with modern techniques, and supervised by men who have specialized in that work.

As mentioned previously, as a logical consequence of Mexico's industrialization, which started in 1946 and is still in process, not only did the amount of electroplating shops in the country increase, but an interest from the technical viewpoint has also been noticeable. At the present time there are over 30 electroplating shops in Mexico City.

Listed below are some of the Mexican companies that operate electroplating shops, and whose electroplated finishes have been successfully applied to equipment and machinery:

LA CONSOLIDADA: Manufacturers of

The barrel plating section in the plant of Industria Electrica de Mexico.

metallic products such as wire, screws, shapes, and automatic parts.

GENERAL ELECTRIC DE MEXICO: Manufacturers of electrical appliances.

LA ESTANADORA NACIONAL: Owns one of the best equipped shops, with a great variety of baths, permitting the application of many kinds of finishes within the scope of modern techniques and with the required control.

GENERAL MOTORS DE MEXICO: Has the equipment and technique required for the application of electrolytic finishes needed in the automobile industry.

D. M. NACIONAL: Manufacturers of household appliances and metal furniture, with an electroplating department installed in accordance with their requirements.

Manufacturers of the "Victor," "Peerless" and "Columbia" records.

Mention is also due to the small shop of *Hidalgo Brothers* which, despite its size, is noted for its good work and because it is probably the oldest in this field in Mexico.

I have purposely left for the last the name of *Industria Electrica De Mexico* (*IEM*), manufacturers of industrial electrical products and household appliances, such as motors, transformers, switchgear, stoves, refrigerators, washing machines and electric irons. I have mentioned it last, because, in my opinion, it is one of the largest and most completely equipped electroplating shops in the Republic of Mexico. It was installed in 1947 at an approximate cost of $85,000 (U. S. currency).

From the following discussion of the operations at IEM it will be seen that a wide diversity of finishes are applied

for protection, for ornamentation, or for special needs, such as silver for contacts.

Copper Plating

There are four types of solutions, as follows:

Barrel copper (144-Gal. capacity); copper cyanide solution (144-gal. capacity), and Rochelle copper (365-gal. capacity) of the conventional type; and, besides, a solution of copper cleaner (250-gal. capacity). Studies are being made on the advisability of installing also a tank for High Speed Copper.

Nickel Plating

The following three types of baths are employed:

Dull nickel, 20 oz. per gallon of single Ni salts gallon, in a tank of 1500-gal. capacity, of semi-automatic operation, employed mainly for electric irons. Bright barrel nickel, in a 144-gal. capacity tank; and, lastly, a tank with a 365-gal. capacity for bright nickel, with its corresponding heat exchanger and equipment for frequent filtrations.

Chromium Plating

With a 360-gallon capacity, functioning at a temperature of 140° F., of the following composition: 40 oz. per gallon of chromic acid per 0.4 of sulphuric acid, and operated at a current of 250 amps. per square foot, which is variable in accordance with the kind of piece treated.

Zinc Plating

Two baths are employed, one of the barrel type with a 144-gallon capacity, and one for large parts with a capacity of 365 gals. These are of the cyanide type with brightening agents added.

Cadmium Plating

Two types are also employed in this plating: the barrel type, 144-gal. capacity, and the conventional type (365-gal. capacity) for large pieces. This bath is based on cyanide and cadmium oxide.

Tin Plating

For this finish, there are two types of baths: the barrel type with a 144-gal. capacity, and the conventional type for large parts with a 365-gal. capacity; both are of the alkali sodium stannate type.

Silver Plating

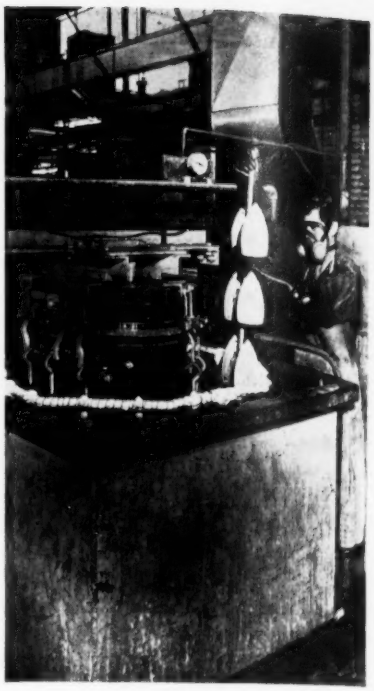
This comprises the strike and the normal process, both of the sodium and silver cyanides type; each with a 365-gal. capacity. The brightener used, in cases requiring it, is carbon disulphide in proportion to the required needs.

Besides the platings already mentioned, the different kinds of hydrochloric and sulphuric acid solutions are also employed, as well as alkaline cleaning solutions, with or without the use of electric current, and, of course, rinsing solutions of cold and hot water. After the first few months of operations, it was also decided that it would be advisable to install a tank for the recovery of chromium plating solution. Besides the acids and cleaners, a degreaser with trichloretylene is also employed, and this completes the cleaning line.

Control Measures

Adequate chemical control is exercised, which comprises a bi-weekly analysis of the majority of the solutions and a weekly analysis of the rest. In order to fix these periods, the plating activity in itself was taken into consideration, as well as the components involved in each solution. Immediately after making the analysis, it is reported by the Chemical Laboratory and any materials found lacking are then added. It may be said that solutions are permanently within specifications.

Next to the electroplating depart-



Semi-automatic dull nickel machine at the author's plant.

ment, another has been installed for preparing parts by polishing, and another department has been installed for buffing when required after the electrolytic process.

Power Equipment

In order to give a more concrete idea of the equipment and capacity of HEM's electroplating shop, which is considered the most modern and most complete within the Mexican industry, I list below the electrical equipment employed:

20 Copper oxide rectifiers (500 amps. output).

1 Motor generator (3000 amps., 8 volts) for chrome plating.

1 Motor generator (3000 amps., 6 volts) for nickel plaitng.

Needless to say, the corresponding control voltmeter, ammeter and thermometer is installed at each tank.

All of this electric equipment is installed within the electroplating room and, in the majority of the cases, in structures above the corresponding tank. The conductors have adequate insulation, therefor losses are reduced to the minimum.

Miscellaneous Procedures

The material of which the tanks are constructed, or with which they are lined is properly selected to suit the solution used. The tanks requiring heat, agitation, vapor aspirators, etc., are duly equipped with this apparatus

which functions whenever the tanks are in use. The personnel of this department has been trained to work under the latest safety regulations and, accordingly, is equipped with rubber boots, aprons, gloves, goggles and masks, which are used when required. Special care has also been taken in assigning a separate place next to the electroplating department, suitable for storing materials employed in preparing solutions and making additions. The personnel in charge of handling materials, has also been trained in safety measures and methods employed in making additions to the solutions.

The foregoing, I believe, will give the reader a general idea of the equipment to be found at IEM, its manner of working, and the kind of finishes obtained.

Before bringing this article to a close, it is only fair to mention that certain persons have concentrated their efforts to the end that proper materials and equipment may be readily obtained by the electroplating industries and, simultaneously, they have collaborated in an attempt to solve each electroplater's problems. Such men include *Messrs. A. Papp* and *M. del Sobral* of the Mexican Du Pont Co., and *M. R. Sanchez*, of Distribuidora Galvanotecnica, S. A.

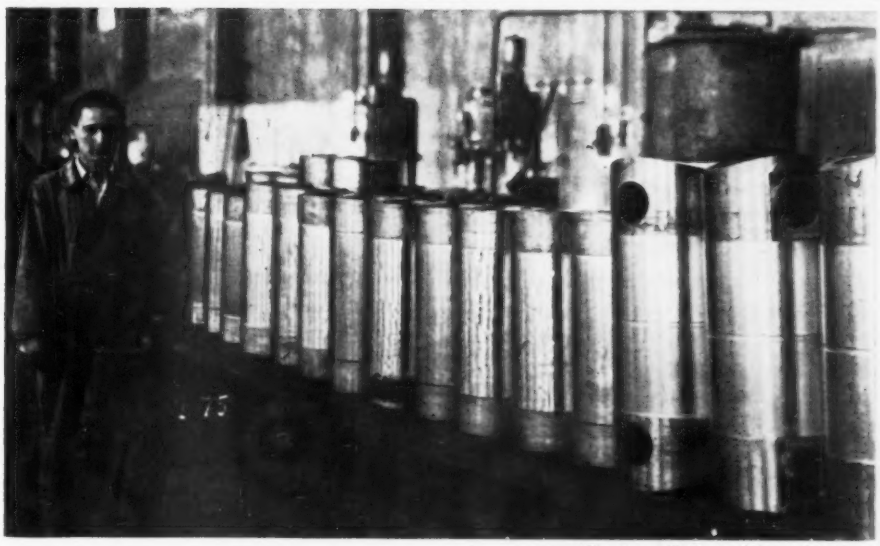
Finally, I would like to express the goal of those whose activities are in the electroplating field in Mexico, that progress will be made towards obtaining the best possible quality in finishes, and to cover the country's entire requirements in this field.

Spain - Part 2

Joaquin Agullo Marly

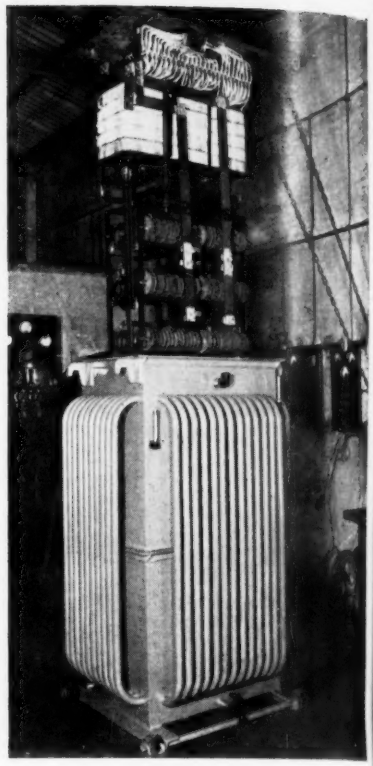
Juan Vericat Raga

AFTER the past civil war in our country in 1939, it was impossible to obtain the necessary industrial equipment of all kinds to meet the national demands. We were obliged to pay for imported items in Spanish agri-



(Courtesy Talleres Nuevo Vulcano)

Diesel engine parts hard chrome plated in Spain.



Showing the construction of an oil-cooled rectifier which is popular in Spain.

cultural products, of which there was hardly enough to take care of our domestic needs. Under these circumstances industry in general, and the metal finishing industry in particular, was unable to import the equipment it needed, as this equipment was not considered as essential to the national economy as were other items.

World War II increased these difficulties and made it necessary for us to develop our own techniques and manufacturing procedures to take care of the industrial demands for metal finishing equipment. Imports of items which could not be obtained locally where held to be an absolute minimum. Nickel anodes and chromium chemicals, which Spain does not have access to, were among the specific plating items which we were allowed to import.

The techniques of rubber lining equipment are well known in this country as we have been rubber lining equipment for the chemical industries for over eight years. Quite a few commercial shops are equipped to do this work.

Because of the great subdivision of Spanish industry, only relatively small plating plants are required. For this reason our plating industry is scarcely adapted to a number of the more modern technical procedures such as automatic polishing and automatic plating. Foreign technicians often overlook this important point when the plating industry in Spain is under discussion. In spite of the lack of automatic equipment, Spanish electroplating plants do have the necessary equipment to take care of our special requirements.

Hard Chrome Plating

Hard chrome plating was introduced to Spanish industry about ten years ago, but the number of installations is still quite low (approximately 30 plants). Most hard chrome baths are about 500 liter size, although there are some which may be as large as 2,000 liters. In general quite modern equipment is used in hard chrome plating and the usual deposition rate is about .05 to .08 mm. (.002"-.003") per hour, but much higher rates of deposition have been tried. Hardness of the chrome deposits is between 1000-1100 Vickers. Power may come from either rotary convertors (motor generators) or selenium rectifiers, which are constructed in Spain except for the imported selenium discs. However, several Spanish manufacturers have development work under way on selenium discs. Some cases where hard chrome plating has been used to advantage are in the plating of marine diesel engine components, textile industry friction rods, and the plating of plastic molds.

Anodizing

Anodizing has been carried out in this country for approximately fifteen

years. The most important process used is the sulfuric acid bath. There are some chromic acid baths used and some plants also practice the coloring of anodized sheets and parts.

Bright Plating

The use of bright plating baths is becoming quite popular in Spain, especially in the factories where the proportion of finishing cost is an important part of the total cost of manufacture. The most used bright plating baths are nickel, silver and zinc. In most cases the dull baths have been changed over by proper additions to make up the bright plating baths.

Electropolishing

While some electropolishing of aluminum is being done, there is not much other use for electropolishing, principally because the base metals produced by the Spanish metal working industry are not uniform, which is one of the most important requirements for successful commercial electropolishing. Several small electropolishing plants are now in operation, one outstanding one being the plant of an optical manufacturer for the polishing of small parts. Some textile and aircraft industry plants have experimental set-ups for electropolishing.

Plating Research

Spain does not have a technical society similar to the American Electroplaters' Society or the British Electrodepositors Technical Society for conducting scientific and practical research on plating problems. In our country such research must be done by each plant to solve its specific problems, and in this case is usually supervised by graduate engineers and chemists. At present several universities and technical schools have installed small plants for research on electrodeposition. At the University of Barcelona research is under way on chrome plating baths, in connection with bath compositions and optimum operating conditions. The *Spanish Association for Metallurgical Research*, which is a private association, annually holds a conference of foreign and Spanish technicians, at which time electrodeposition is one of the subjects under discussion. We lack the research organizations that are available to American electroplaters.

To summarize our position, Spanish plating technicians are well aware of the American and British developments

in automatic equipment and modern finishing procedures, but the technical problems are overshadowed by the economic problem of a shortage of dollars with which to purchase the most modern equipment.

Business Items

Louis C. Sobey Joins Lasalco Sales Force

Louis C. Sobey

A recent addition to the sales force of *Lasalco Inc.*, of St. Louis, Mo. is *Mr. Louis C. Sobey.*

Mr. Sobey has had wide experience in the plating field. He has served as Production Manager of Plating & Galvanizing Co., Cleveland, O. for 10 years prior to his owning and operating the Sobey Rustproofing Co., in Cleveland for a period of 4 years.

Mr. Sobey's technical background as well as his practical experience should stand him in good stead in the territory assigned him.

Making his home in Solon, O., "Louie" will cover Northwestern Ohio, Northern Indiana and Southwestern Michigan.

Buckeye Products Expands Plant Facilities

The Buckeye Products Company of Cincinnati, manufacturers of buffing and polishing compounds, have just completed the second expansion to their plant since the end of the war. The sale of the company's SPEEDIE buffing and polishing compositions and polishing room accessories has risen so markedly in the past several years that it was necessary to erect a new building

to provide additional space for both manufacturing and warehouse facilities. Considerable new equipment has also been installed in the plant so as to increase production and give engineers improved methods for constantly checking the uniformity of all products manufactured in the Cincinnati factory.

In 1947 The Buckeye Products Company erected a new boiler plant and modern offices. Officials of the company state that additional production equipment will be installed in the plant this year as soon as it is available from the manufacturers.

Butcher Co. Adds Two To Lab Staff

The *L. H. Butcher Co.*, of Los Angeles, Calif., suppliers of metal finishing equipment and supplies, have announced the addition of two new laboratory staff members, *Mr. Irving Halpern* and *Mr. Arthur Heath*. Mr. *Halpern* was formerly chief chemist for Aviation Maintenance Corp., Mr. Heath is a recent graduate from the Univ. of Calif. in Chemistry.

Another recent addition to their sales staff is *Mr. Don Fish*, formerly with the Technical Glass Co., Mr. Fish will cover the territory formerly covered by Harold Preston.

Alrose Appoints Mid-West Representative

Mr. Ralph E. Kaye, Jr., has joined the *Alrose Chemical Co.*, of Providence, R. I., as mid-west sales representative, with headquarters at the new Alrose-Chicago office, 629 West Washington Boulevard. Mr. Kaye was formerly associated with the *Atlas Powder Company*.

Handy & Harman Elects New Executive Officers

At the Annual Meeting of stockholders of *Handy & Harman* held on April 19th, the following directors were elected:

Howard W. Boynton, John W. Colgan, Cortlandt W. Handy, Frank C. Jones, Robert H. Leach, Gustav H. Niemeyer, Harry E. Radix, Judson C. Travis.

Mr. Frank C. Jones, Manager of The Bridgeport plant for the past nine years, is a new member of the Board. *Mr. Thomas G. McMahon*, formerly a director, has resigned.

At the organization meeting of the newly-elected Board of Directors, the following officers were elected as of May 1st:

Cortlandt W. Handy, chairman of the Board; *Gustav H. Niemeyer*, president; *Judson C. Travis*, executive vice-president; *Howard W. Boynton*, vice-president and treasurer; *Robert H. Leach*, vice-president; *John W. Colgan*, vice-president and sales manager; *Richard G. Jones*, secretary.

Mr. Travis, in his new office of Executive Vice-President, will be responsible for the sales, manufacturing, refining and research operations of the company and will have general charge of its five plants. Mr. Boynton is a newly-elected Vice-President. In addition, he will continue to serve as Treasurer of the company but not as Secretary. Mr. Leach will continue as a Vice-President. He has retired from active management but will act as consultant and advisor in matters concerning production, research and metallurgy. Mr. Colgan is also a newly-

elected Vice-President in which capacity he will function as Sales Manager. Mr. Richard G. Jones is the newly-elected Secretary. He will continue as Controller of the company, which office he has held for the past five years.

Osborn Elects Parnall and Wier Vice Presidents

The election of *A. B. Parnall* to Vice President, Manufacturing, and *Robert Wier, Jr.* to Vice President, Brush Division Sales, of The *Osborn Manufacturing Co.*, manufacturers of industrial brushes and foundry moulding machines, was announced recently.

A. B. Parnell

Mr. Parnall joined Osborn in 1925 as a plant worker. He rose steadily over the past 25 years from stock clerk to timekeeper, to inventory control, to payroll department. In 1933 he supervised the Cost and Estimating Departments for the Brush Division. He was made chief accountant in 1936 and controller in 1939. He assumed the duties of Treasurer, his most recent position, in 1942. Mr. Parnall is a member of the Treasurers Club, the Controllers Institute and the American Forestry Association.

Mr. Wier joined Osborn in 1945 as general sales manager. Prior to joining Osborn, he was sales manager for the Western-Winchester Divisions of Olin Industries, a position he held from 1942 to 1945. From 1926 to 1942, he was district sales manager for Sun Oil Company.

Mr. Wier was graduated from Yale in 1918 with a degree in Mechanical Engineering. He joined the Hearn Company that year as a salesman and rose to be vice president before the company was sold to the Sun Oil Company. He is a vice president of The American Brush Manufacturers Association, and serves on the executive committee of The American Supply and Machinery Manufacturers Association.

Robert Wier, Jr.

Electric Products Co. Appoints New York State Agents

The Electric Products Co., Cleveland, O., has appointed *Vincent J. Brown Company* as District Representatives for New York State, with the exception of metropolitan New York City.

The Vincent J. Brown Company maintains offices in Buffalo and Syracuse and will be responsible for promoting the Electric Products Co. line of synchronous and induction motors, A-C and D-C motors and generators, battery chargers, electrolytic power supplies, and frequency changers.

President of Handy & Harman Honored on 50th Anniversary

Handy and Harman, refiners and fabricators of precious metals, honored their president, *G. H. Niemeyer* recently at a ceremony commemorating his fiftieth anniversary with the company.

J. C. Travis, vice-president of the firm, acting for the entire company, presented Mr. Niemeyer with a handwrought gold cigar box, lined in mother of pearl with a portrait medallion of his head on the cover, "in recognition of his vision and leadership." Accompanying the box was a leather bound book signed by the officers, directors and employees of the company. The presentation took place at a company dinner given in his honor at the Waldorf Astoria.

Mr. Niemeyer joined the company as an office boy on May 1, 1900. His colleagues have described his career as virtually a history of the industry since the opening of the twentieth century. He became Handy and Harman's first salesman in 1902 and traveled for the firm until 1915 when he was appointed manager of the New York plant, then sales manager and later vice-president in charge of sales. In 1938 he became president.

G. H. Niemeyer

Throughout his business career his emphasis has been on service. In describing his start in life Mr. Niemeyer said: "I was born in Illinois, spent most of my early years on a farm and started with nothing. Whatever success I have achieved has been largely due to the fact that I was born in a free country and, under our system of free enterprise, had a chance to make what I could of my life."

Shapiro Appointed Foreman at Gillette

A recent appointment at the *Gillette Safety Razor Co.* in Boston made *Mr. M. Shapiro* foreman of the plating department. Previous to this he had served as assistant foreman and super-

visor of the electroplating laboratory. He has been connected with the firm since 1943, and is a member of the Boston Branch of the A.E.S. and the Electrochemical Society.

Electric Equipment Co. Purchases New Plant

The Electric Equipment Co., Rochester, N. Y., one of the nation's largest dealers in motors, generators, and transformers, has purchased a million dollar Government-built plant, it was announced by *Irving S. Norry*, president of the firm. The new factory, located in Rochester, has 59,000 square feet of floor space and is on the Baltimore and Ohio Railroad.

The purpose of the purchase is to consolidate the company's activities, which at present, include warehouses in Rochester, Buffalo, Watertown, Canton, Ohio, and Houston, Texas.

Detroit Branch Annual Stag Day

The Detroit Branch of the AES will hold its annual Stag Day on Saturday, July 29th at the Forest Lake Country Club.

Features of the day will be: Golf and other athletic contests; free beer and pretzels; a 5-course tenderloin steak dinner; floor show.

Walter Pinner, chairman of the event, invites all AES members to attend this congenial, entertaining and good-time gathering. Tickets at $5.00 and full details can be obtained from *Frank Clifton*, 16536 Inverness Ave., Detroit 21, Mich.

RECENT DEVELOPMENTS

Unbreakable Pail for Acids and Alkalis

American Hard Rubber Co., Dept. MF, 11 Mercer St., N. Y. 13, N. Y.

Said to be practically indestructible, this new three-gallon chemical pail adds greater safety to the handling of virtually any type of corrosive solution. Ace-Hide, according to its makers, is a new, tough, resilient, high-styrene, copolymer rubber that provides an excellent combination of light weight, corrosion resistance and strength.

Feature of the new pail is its carefully designed pouring spout which virtually eliminates dangerous drip and keeps the corrosive chemicals from running down the outsides of the pail. It pours an easily directed stream, making it possible to pour directly into narrow-necked vessels, it is claimed. An easy-to-read scale on the inside of the pail is marked off in half-gallons.

Abrasive Grains

Simonds Abrasive Co., Dept. MF, Tacony & Fraley St., Phila., Pa.

This firm manufactures abrasive grains for all purposes, including polishing abrasives, blast cleaning grits

tumbling abrasives, and anti-slip grains. Quality control from the mine to the finished product results in the highest quality product in a wide range of grit sizes and types. Borolon polishing abrasives are uniform in size, hardness, and toughness, according to the firm, and result in maximum cutting life for polishing all metals. Their tumbling abrasive is marketed under the trade name Borogrit, and their blasting abrasive under the name of Boro-blast. Samples and literature are available on request to the above address.

Activating Nickel Plated Parts

L. H. Butcher Co., Dept. MF, 3628 E. Olympic Blvd., Los Angeles 23, Calif.

Recently announced by this firm is their Chrom-Acto, a material which is added to a sulfuric acid dip to activate nickel plated parts before chrome plating. The firm claims that this treatment will eliminate clouds and streaks due to poor rinsing and solution impurities, and will permit the chrome to cover deeply recessed parts. The material is a dry salt, and is used in a concentration of 1½-2 lbs. per 100 gallons. Further details may be obtained by writing.

Metal Parts Retrieved with Tank Magnet

Eriez Mfg. Co., Dept. MF, Erie, Pa.

For removing ferrous parts from electroplating tanks, alkali baths, acid baths, etc. this firm is offering a low-cost permanent magnetic device.

Made of stainless steel, the tank magnet is claimed to be temperature-proof, acid and alkali-proof. It is operated very much like a carpet sweeper, with the magnetic tube mounted between neoprene wheels. Ferrous material moves to the magnet and spreads itself over the entire circumference to a thickness of about ¾". Unloading is accomplished at either end by simply pushing the upper ring from one end of the tube to the other, where a non-magnetic section causes the load to be released.

The unit is light and easy to handle. It will not attach itself to the tank. 48" overall length; 16¼" and 21⅛" widths.

Gold Alloy Plating Baths

Platers Research Corp., Dept. MF, 59 E. Fourth St., N. Y. 3, N. Y.

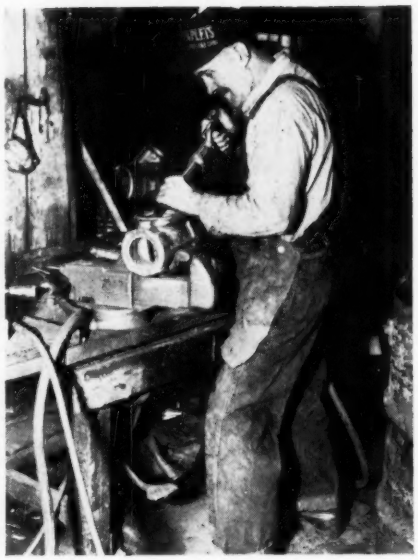
This firm announces the development of their Auralloy gold plating process, which is claimed to make possible the deposition of hard gold alloys in various popular shades. For flash deposits, it is claimed that no

pre-plate is required to produce Hamilton, pink, and green colors, and that such flash deposits will wear longer than those produced by other processes and having the same gold content. The bath is said to be very good for heavy deposits. The baths will be made available as concentrates, and the usual technical help is offered to prospective users.

Hydraulic Vise for Casting Cleaning

The Columbian Vise & Mfg. Co., Dept. MF, 9017 Bessemer Ave., Cleveland 4, O.

Casting cleaning is made considerably easier with this hydraulic vise. Operator uses both hands to lift and position casting into vise, then with three or four pushes on the foot pedal, the front jaw of the vise closes and securely holds casting in required position. Maximum gripping pressure between the jaws is about 6,000 p.s.i. A safety valve protects against overloading. The vise stays locked until release pedal is pushed, and the vi-



bration caused by the air hammer will not cause the jaws to loosen, it is claimed. Jaws can be closed without crushing or marring light castings or finished surfaces; to show how fine an adjustment can be made, the manufacturer closes the jaws on an egg.

Abrasion Tester

Taber Instrument Corporation, Dept. MEF, 111 Goundry St., North Tonawanda, N. Y.

The new Taber Abraser incorporates the rotary rub-wear action of dual abrading wheels criss-crossing their abrasion path. The action is continuous throughout the 360° rotation of the specimen and is claimed to closely parallel abrasive wear encountered in actual use.

The new machine features sturdier shafts and larger ball bearings, a capacitor type motor with heavy duty worm-gear drive, extra powerful vacuum unit with dual suction nozzle for high efficiency pickup of abradings, and electric counter for registering the wear cycles. The two sets of stainless steel weights, in addition to the weight of the arm, provide three standard ranges of wheel pressures against the specimen, namely, 250, 500 and 1,000 grams. Provisions have been made for counter-balancing the weight of the abrading wheels when using the 250 grams load.

A variety of holders for different kinds of specimens have been developed, such as the rimmed specimen holder that can be partially filled with a liquid sufficient to wet the specimen or completely cover it while undergoing abrasion test. Specimens cut from a flat sheet, or coatings applied to specimen plates are usually tested on the "flat top" holder.

Resilient type *Calibrase* wheels used to abrade both hard and soft materials are supplied in five types.

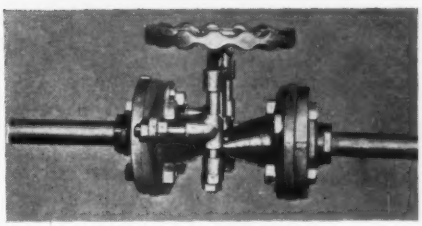
Quantitative or total wear of a specimen surface is indicated by the counter reading from the start of the test to the first sign of penetration, like a spot worn through a coating.

Pinch Valve for Corrosive Handling

United States Rubber Co., Dept. MF, Rockefeller Center, N. Y. 20, N. Y.

A new rubber pinch valve for use in the chemical industry has been developed by the mechanical goods division of U. S. Rubber Co.

The new valve will outwear metal



when installed in pipelines carrying abrasive or corrosive mixtures, the company claims. Its flexibility will offset misalignment in pipes. No packing or repacking is required. It absorbs vibration, eliminates "water hammer," and affords a positive seal in the closed position, according to the firm. It will also break up galvanic action in metal lines.

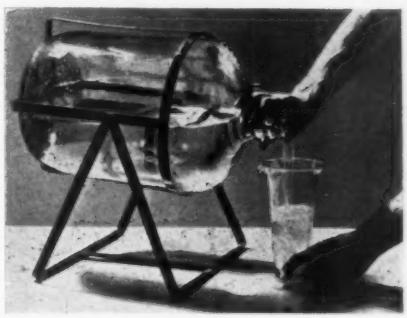
Valves are available in abrasive and corrosive-resistant compounds, neoprene for oil resistance, butyl rubber for high heat and severe acid conditions, etc.

Design of the valve is compact, with mechanism, retaining rings and pinch valve body in one unit.

5 Gallon Bottle Tilter

General Scientific Equipment Co., Dept. MF, 2700 W. Huntingdon St., Philadelphia 32, Pa.

The GS tilter for 5 gallon bottles provides a safe and easy method of pouring liquids into smaller containers. It is designed to prevent accidents caused by spilling, splashing and carelessness in pouring liquids.



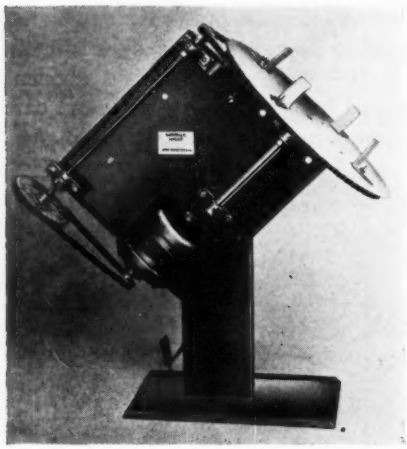
A chain is provided to hold bottle in position when tilted. The cradle is made of steel. All members are riveted or welded to insure a strong and durable device for this purpose.

Portable Tumbler-Mixer

Rampe Mfg. Co., Dept. MF, 3029 Prospect Ave., Cleveland 15, Ohio.

A new, low-cost, portable universal Tumbler-Mixer has just been placed on the market by the above firm.

This machine, which can be moved from one job to another, tilts through a full 90° arc, so that the work can be tumbled at the best angle.



The Tumbler-Mixer is adapted to many uses, due to the adjustable turn table clamps that allow standard and odd-shaped containers to be used. Easy to hold a 5-gallon pail, wooden box, can, jug, stone ball mill, laboratory beaker or any other shaped container, it is claimed. Regular octagonal tumbling barrels of steel or non-metallic materials furnished as extra equipment.

Ideal for small lots in large or small shops, experimental departments, laboratories, chemical plants, etc.

Specifications include anti-friction bearings throughout. 1/6 H.P. motor. 19" turn table. Floor space required 19" x 32". 35" high. Weight 80 pounds.

Bench Blast Cabinet

The W. W. Sly Mfg. Co., Dept. MF, 4700 Train Ave., Cleveland 2, Ohio.

Designed for the abrasive blast cleaning of small parts such as automobile pistons, dies, tools, castings, etc., this portable bench blast cabinet will operate on the compressed air supplied by a standard 5 hp., 2-stage garage compressor. The operator loads the parts through the top hinged cover and observes the work through the window in the cover. Operator's hands in the rubber gloves rotate the work in the blast stream. A ventilating fan draws off the dust which is retained in a removable filter bag. Effici-

ent vision during blasting is provided by a side-mounted light. Cabinet only requires bench space of 14" x 18".

Lucite Cylinders for Sethco Filters

Sethco, Dept. MF, 105-107 150th St., Jamaica 4, N. Y.

This firm announces that a new line of high-temperature Lucite filter cylinders is now in production. These can be had either incorporated with a stainless steel or Hastelloy pump, or separately to be hooked up into your own filter pump. The advantages of filtering with these filter cylinders are:

1. Complete resistance to all electroplating solutions, including highly acid solutions and highly alkaline solutions.
2. High temperature solutions (up to 200°F.) can be filtered.
3. Simple operation; it takes less than 1 minute to get going on any filtration job.
4. No loss of expensive solutions; filter cylinder holds less than 1 quart of solution, which is completely recoverable.
5. Filter tube can be backwashed or washed: filter element is a specially processed cotton yarn wound around a stainless steel supporting core. Many thousands of gallons of solution may be filtered through the filter tube, and it can be used over and over again.
6. Crystal clear filtration; filter tubes are wound so densely that even the finest particles are satisfactorily removed, it is claimed.
7. Progress of the filtration can be watched through the transparent Lucite cylinder.

Available in two sizes; 50 gallons per hour, and 100 gallons per hour.

Manufacturers' Literature

Protective Chemicals and Processes

American Chemical Paint Co., Dept. MF, Ambler, Pa.

A new reference list just published by this firm explains the uses for their line of metal finishing and protective chemicals and processes. The bulletin includes phosphating processes, rust removers, cleaning chemicals, and pickling inhibitors. Various processes are described for the complete range of industrial metals. Copies are available on request.

Immersion Electric Heaters

Edwin L. Wiegand Co., Dept. MF, Pittsburgh 8, Pa.

A new catalog just issued by this firm illustrates and gives engineering data on their line of electric immersion heaters, strip heaters, air blast heaters, radiant heaters, and many more in a wide range of sizes and styles. Copies of the bulletin may be had by addressing the above concern.

Cleaning and Processing Aluminum

Magnuson Products Corp., Dept. MF, 50 Court St., Brooklyn, N. Y.

A new booklet incorporating the experience gained in 27 years has been issued by this firm, and is titled "Permag for Aluminum Cleaning and Processing."

The latest information on Permag cleaning and processing materials is carefully indexed to assist those who have to deal with fabrication and

maintenance of aluminum surfaces. New materials and new methods are included which cover all cleaning and chemical preparation operations before the final finish.

Specifically covered are such items as hot tank immersion cleaning, washing machine cleaning, solvent cleaning, steam cleaning, burnishing, frosting, stripping, cleaning before anodizing, and other operations.

Preventing In-Process Rusting

Oakite Products, Inc., Dept. MF, 118 Thames St., New York 6, N. Y.

How to combat rust throughout the production process in metal-working plants is the subject of a special Service Report just published by this firm, manufacturers of industrial cleaning and allied materials.

This Service Report offers a concise description of specialized materials and procedures that (1) remove rust from raw stock; (2) clean and de-rust in *one* operation; (3) prevent rust while parts are being processed; and (4) prepare metal for paint while affording protection against rust before and after painting. Also reported upon are materials, for use by machine or tank methods, that remove buffing compounds, drawing and stamping compounds, cutting and grinding lubricants, mill and slushing oils, solid-particle dirts and smuts from metal parts, and at the same time provide efficient temporary protection against rust.

Industry personnel desiring copies of this new Service Report may obtain them, without charge, by writing.

Cleaning Machines

Cincinnati Cleaning and Finishing Mach. Co., Dept. MF, Ironton, O.

This firm has issued a new catalogue depicting the many applications for their line of automatic washing and cleaning machines. Various types of machines supplied by Cincinnati include conveyor, monorail, drum type, combination drum and conveyor, turntable, strip type, cabinet type, agitating type, and many other special application machines. In addition, the firm makes paint spray booths, phosphating machines, and auxiliary equipment. The characteristics of each type of machine are outlined to help the production engineer make a correct choice.

Buff Catalogue

Chas. Maury & Co., Dept. MF, 50 Quentin Road, Brooklyn 23, N. Y.

A recent catalogue issued by this firm illustrates and describes their complete line of buffs. All materials, sizes, and types of sewing are available. The firm also carries a line of compositions, wheels, and polishers supplies. Copies of the bulletin are available on request.

Rubber Lined Equipment

The B. F. Goodrich Co., Dept. MF, Akron, O.

Covering the subject in detail, a new eight page catalog section on its rubber-lined pipe, fittings and valves has been issued by this firm. Copies are now available upon request.

The catalog section gives the design, construction and service recommendations, lists many uses and pictures and describes the products. These include, besides rubber-lined pipe, gaskets for flanged pipe assembly, expansion joints, Flexseal connectors to reduce vibration in lines, Vulcalock valves, rubber-lined and relinable valves. Specifications and data are listed.

Phosphate Coating Selection Chart

American Chemical Paint Co., Dept. MF, Ambler, Pa.

This firm has recently issued a chart which will enable a user to select the correct phosphate treatment for a wide variety of uses. Data included in the selection chart on the base metals, type of coating produced, chemicals required, pre-cleaning methods, phosphating bath conditions, coating weight obtained, testing, and government specifications that pertain. Copies of this chart are available on request to the above address.

High Temperature and Corrosive Service Products

Strohecker Incorp., Dept. MF, Enon Valley, Penna.

A line of equipment that resists heat and corrosion is described in a new booklet published by this firm.

Among the equipment described and illustrated are: enameling burning tools that saved 30% on the user's fuel bill because of their very light weight; pickling fixtures so strong and light that production increases as high as 75% per carrier have been obtained; heat treating carriers for service up to 2300°F.; alloy chain for every requirement.

Courses In Electroplating

Summer Electroplating Courses

The *Joseph B. Kushner Electroplating School* of Stroudsburg, Pa., announces the inauguration of three intensive one-week summer lecture courses in special electroplating subjects, to be given in Stroudsburg, Pa., heart of the Pocono Mountains, nationally known vacation paradise.

The purpose of the courses is to provide an opportunity to study special topics in plating during part of their usual vacation time, in delightful and informal country surroundings. The course work, while intensive, will allow ample time for students to indulge in other vacation activities for which the region is famous. If desired, arrangements will be made to accommodate the families of married students at any of the many resort hotels, inns, tourist homes and boarding houses that abound in the area.

The course subjects and dates are as follows:

Week of August 6. MODERN ELECTROPLATING PRINCIPLES. A comprehensive survey of the theoretical principles behind modern electroplating practice. High school education or better required.

Week of August 13. GOLD PLATING TECHNIQUES AND PROBLEMS. Special techniques and modern methods in gold plating. An intensive lecture course for those with previous experience and knowledge in gold plating only.

Week of August 20. RECENT DEVELOPMENTS IN ELECTROPLATING. A thorough survey of new and recent developments in electroplating and their importance. The direction of future

trends in electroplating. Lecture course for executives, chemists and engineers.

The classes will be personally conducted by *Joseph B. Kushner*, and will be limited to an enrollment of twenty so that each student may receive individual attention. An informal atmosphere will prevail at the sessions, which will be held out of doors whenever possible.

The tuition fee per course is $30, which covers enrollment and original text material supplied to each student. Accommodations, including room and board, are separate, and will be arranged for by the school if desired, according to the student's request. Current room and board rates range locally, from $35 and up, per week.

All enrollments, and reservations for accommodations must be placed before July 15 and should be made by writing to Joseph B. Kushner, Director, Joseph B. Kushner Electroplating School, 115 Broad St., Stroudsburg, Pa.

Free Evening Course in Electroplating

An evening lecture and laboratory course in Industrial Electrochemistry and Electroplating will be given at the Brooklyn Technical High School starting in September, 1950. There will be no charges involved in taking the course, which will cover basic chemistry, electrochemical principles, chemical analysis, and practical electroplating. Emphasis will be on laboratory work, wherein the students will carry out investigations in cleaning, electro-

cleaning, bright plating, and plating from all the commercial baths. Field trips to commercial plating plants and lectures by guest experts are also planned.

Anyone interested in taking this free course should contact, preferably by writing, *Mr. James P. Striffler*, Brooklyn Technical High School, DeKalb Ave. & Fort Greene Place, Brooklyn, N. Y. Early registration is suggested, as the number of persons who can be accommodated may be limited, and will be on a first come-first served basis.

SHOP PROBLEMS

Electropolishing Tungsten

Question: Can you give us a formula for a bath that can be used for electropolishing tungsten metal and alloys of tungsten with cobalt and other metals?

W. A. J.

Answer: A number of baths for electropolishing tungsten are known. Two of these are as follows:

1) Sodium Hydroxide 100 gm./L.
Water balance

This solution is used at room temp. at 0.2-0.4 amperes per sq. inch. About 25 minutes may be required for a good polish.

2) Trisodium phosphate 160 gm./L.
Water balance

This bath is used at 100-120°F. at 0.6 amps./sq. in. The time required is about 10 minutes.

Whether or not these baths will work on alloys can only be determined by trial. In general, if the alloys are single-phase materials, the results are about the same as with pure metal, but for alloys where two or more phases are present these may not work satisfactorily.

Bright Plating Small Chain

Question: We recently had some trouble with a lot of small chain that had been too deeply etched, in that our gold plating would not come out bright. Can you suggest a method that we could use to treat this material so that we can get a nice smooth flash gold plate on it?

O. V.

Answer: Unfortunately there is very little that can be done to restore the smooth finish to such small chain. Tumbling the chain for a long period of time may restore some of the lustre. Another suggestion would be to bright nickel plate the chain for a few minutes, followed by the gold.

Analytical Calculations for Boric Acid

Question: Can you explain how the factor 5.25 is derived in the calculation of boric acid in nickel baths as given on page 289 of the Guidebook-Directory (1947 Edition). I am sure the figure is right, but am puzzled by its derivation.

S. A. J.

Answer: The figure is derived as follows: One ml. of exactly N/10 NaOH is equivalent to .0063 grams of oxalic acid. Therefore the amount of *exactly* N/10 NaOH theoretically required to neutralize .20 gms. (the sample weight used in the standardizing step) of oxalic acid would be 31.7 ml. (.20÷.0063).

This figure 31.7, which is the *theoretical* amount of N/10 NaOH required, divided by the *actual* titration figure for .20 gms. of oxalic acid, gives the strength of the NaOH in terms of its relation to N/10 (often called its normality factor).

Now, when titrating a sample for boric acid determination, the mls. of this NaOH used × its factor × its boric acid equivalent (.00619 gms. per ml.) × 26.7 (to convert gms. per 5 ml. to oz./gal.) gives the oz./gal. of boric acid. Or

$$\frac{31.7}{x} \times .00619 \times 26.7 = \text{oz./gal.}$$

Boric acid when using a 5 ml. sample of the plating solution.

Combining these multiplications, $\frac{31.7 \times .00619 \times 26.7}{x} = \frac{5.25}{x}$ we get

where x equals the mls. of NaOH used in neutralizing the oxalic acid in the standardizing step.

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Per column inch per insertion

1 time	$7.50
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6 times	6.50
Yearly (12 times)	6.00

READY-REFERENCE SECTION
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ETC.

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AVAILABLE FOR IMMEDIATE SHIPMENT

PLATING MOTOR GENERATOR SET (REBUILT) WITH COMPLETE PANEL EQUIPMENT—MOTORS—3 phase, 60 cycle, 220/440 volt SYNCHRONOUS.

1—CHANDEYSSON ELECTRIC, 1000/500 ampere, 6/12 volt, 900 RPM. Exciter in head, 40 Deg. C. Serial No. 28874.

1—CHANDEYSSON ELECTRIC, 750/375 ampere, 12/24 volt, 720 RPM. Exciter in head, 25 Deg. C. Serial No. 29192.

1—CHANDEYSSON ELECTRIC, 1500/750 ampere, 12/24 volt, 720 RPM. Exciter in head, 40 Deg. C. Serial No. 30350.

1—CHANDEYSSON ELECTRIC, 4000/2000 ampere, 6/12 volt, 450 RPM. Exciter in head, 25 Deg. C. Serial No. 29022.

1—HANSON-VAN WINKLE-MUNNING, 4000/2000 ampere, 6/12 volt, 600 RPM. Exciter in head, 40 Deg. C. Serial No. 9635.

1—ELECTRIC PRODUCTS, 5000/2500 ampere, 12/24 volt, 600 RPM. Exciter in head, 40 Deg. C. Serial No. 19987.

FOLLOWING SETS—SYNCHRONOUS—3 phase, 25 CYCLE, 220/440 volts—COMPLETE.

1—ELECTRIC PRODUCTS, 1500/750 ampere, 6/12 volt, 500 RPM. Exciter in head, 25 Deg. C. Serial No. 21295.
1—CHANDEYSSON ELECTRIC, 3000/1500 ampere, 6/12 volt, 375 RPM. Exciter in head, 40 Deg. C. Serial No. 26174.

SACRIFICE FOLLOWING PLATERS, INDUCTION MOTOR DRIVE, WITH COMPLETE PANEL EQUIPMENT—3 phase, 60 cycle, 220/440 volt.

1—BENNETT & O'CONNELL "Excel-All," 3000 ampere, 8 volt, double commutator, 775 RPM. M. G. Exciter, 40 Deg. C. Serial No. 5038.

1—A. P. MUNNING "OPTIMUS," 5000/2500 ampere, 6/12 volt, 490 RPM. M. G. Exciter, 40 Deg. C. Serial No. 6296.

1—BOGUE ELECTRIC, 5000/2500 ampere, 6/12 volt, 575 RPM. M. G. Exciter, 40 Deg. C. Serial No. 725.

PLATERS' BARRELS (REBUILT) Motor Drive—3 phase, 60 cycle, 220/440 volt.

10—Mechanical "Horizontal Type" Single and Double barrel units—new and used. Terrific assortment of Belke and Crown.

5—UDYLITE "Utility" Platers.

14—CROWN—BAIRD—LASALCO — Size No. 1 and No. 2—Ball-Burnishers.
6—BAIRD—GLOBE "Oblique" Tumblers.

POLISHING LATHES—NEW AND USED—CONSTANT AND VARIABLE SPEED—

3 phase, 60 cycle, 220/440 volts—1 to 20 H.P.

RECTIFIERS—General Electric — Mallory Udylite—SELENIUM—50 to 6000 ampere sizes, 6/12 volt, with regulators, 3 phase, 60 cycle, 220/440 volt.

ALSO—AVAILABLE—OTHER NEW AND USED—GENERATOR SETS AND RECTIFIERS—ranging in size from 50 ampere to 10,000 ampere.

WE CARRY A COMPLETE LINE OF NEW AND USED PLATING AND POLISHING EQUIPMENT AND SUPPLIES.

CLINTON SUPPLY COMPANY
112 South Clinton Street
Chicago 6, Illinois

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BUFFS

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Loose and Sewed

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Any Quantity

MICHIGAN BUFF CO., INC.
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PLATERS AND RECTIFIERS

Amps	Volts	Spd.	Make	Motor
60	5	1800	Acme (vert.)	110-3/60
100	7½	1800	Hobart	110/220-1/60
300/150	6/12		Chandeysson	220/440-3/60
500	40		M. G. Corp.	220/440-3/60
1000/500	6/12		Elec. Prod.	220/440-3/60
1000/500	6/12	1200	Bogue	220/440-3/60
1000	3/50	900	H. & V. W.	220-3/60
1000	6	1200	H. Van Winkle	220-3/60
1500/750	8/16	900	El. Prod.	440-3/60
1500/750	6/12	600	Chandeysson	220-3/60
2000/1000	6/12	600	H. Van Winkle	220-3/60
3000/1500	6/12	720	Meaker	220-3/60
3000/1500	12/25	600	H. & V. W.	220-3/60
5000/2500	6/12	490	Munning	

RECTIFIERS

1000	6	Selectro	485 Volt, 3/60	AC input
2000	6	Selectro	485 Volt, 3/60	AC input

THE MOTOR REPAIR & MFG. CO.
1555 HAMILTON AVE., CLEVELAND 14, O.

PLATING UNITS

WANTED — Udylite multiple barrel plating units for Cyanide Solutions barrel plating unit for Nickel Solution.

THE INDUSTRIAL PLATING CO.
4415 Czar Avenue — Cleveland 4, Ohio

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REBUILT AND GUARANTEED EQUIPMENT FOR

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- SPRAYING
- ELECTROPLATING
- METAL FINISHING

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Motor Generator Sets, Rectifiers, Wood, Steel, Lead Lined and Rubber Lined Tanks, Steam Boilers, Rheostats, Polishing, Buffing and Grinding Machines and everything needed for a modern metal finishing department.

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AVAILABLE FOR IMMEDIATE SHIPMENT — ATTRACTIVE VALUES

THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS AND RECTIFIERS, WITH FULL CONTROL EQUIPMENT:

1—**15,000/7500 Ampere, 6/12 Volt, Columbia Electric Co.** with Separate M.G. Exciter.

1—**10,000/5000 Ampere, 6/12 Volt, Hanson-Van Winkle-Munning Co.** Separately Excited. Synchronous Motor. Excellent Condition.

2—**7500/3750 Ampere, 8/16 Volt, Hanson-Van Winkle-Munning Co.** Separately Excited Synchronous Motor.

1—**5000/2500 Ampere, 6/12 Volt, Munning "Optimus."** Separately Excited.

1—**3000/1500 Ampere, 6/12 Volt, Chandeysson Electric Co.** Synchronous Motor. Exciter-In-Head.

1—**3000/1500 Ampere, 6/12 Volt, Electric Products Co.** Synchronous Motor. Separately Excited.

1—**2000/1000 Ampere, 12/24 Volt, Hanson-Van Winkle-Munning.** Separately Excited.

1—**1500/750 Ampere, 6/12 Volt, Hanson-Van Winkle-Munning.** Shunt Wound. Separately Excited.

3—**1250 Ampere, 15 Volt, Columbia Electric Co.** Exciter-In-Head.

2—**1000/500 Ampere, 6/12 Volt, Charles J. Bogue Electric Co.** Separately Excited. Interpole Design. Exciter-In-Head.

1—**750 Ampere, 12 Volt, Chandeysson Electric Co.** Synchronous Motor. Exciter-In-Head.

1—**1500 Ampere, 40 Volt, Hanson-Van Winkle-Munning** Anodizing Synchronous MG Set. Automatic Controls. Exciter-In-Head.

1—**1000 Ampere, 40 Volt, Hanson-Van Winkle-Munning Co.** Anodizing Synchronous MG Set. Exciter-In-Head.

1—**1000 Ampere, 25 Volt, Hanson-Van Winkle-Munning Co.** Separately Excited. Anodizing Unit.

Other Sizes of Electroplating and Anodizing Motor Generator Sets in Stock.

4—**G.E. Copper Oxide Rectifier, 500 Ampere, 6 Volts,** for operation on 220/3/60.

3—**Hanson-Van Winkle-Munning Copper Oxide Rectifiers, 500 Amperes, 6 Volts,** with 220/440 volt, 3 phase, 60 cycle input.

— SPECIAL —

3—**Divine Bros. Buffing Lathes, NEW. 7½ Hp. 220/3/60/2800 Rpm.**

— PRICED RIGHT —

M. E. BAKER COMPANY
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KIRKLAND 7-5460